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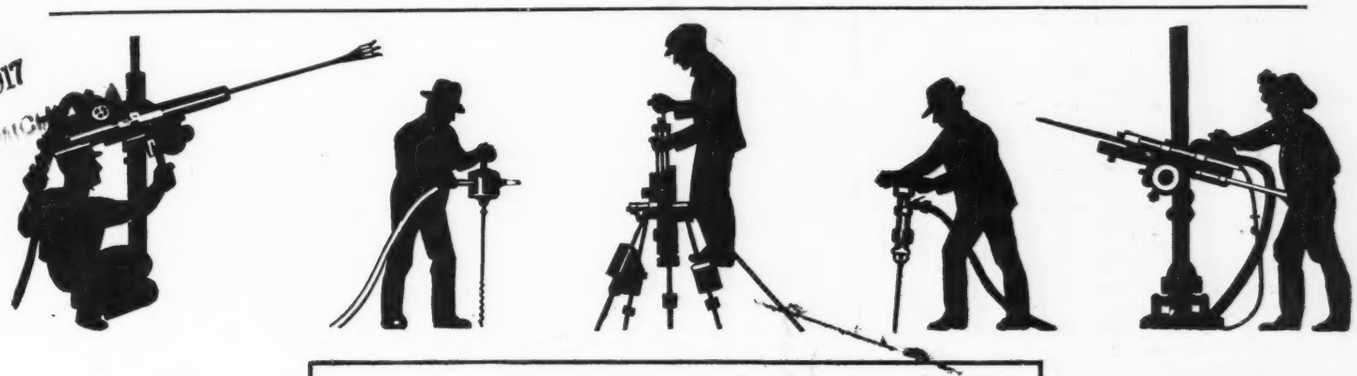

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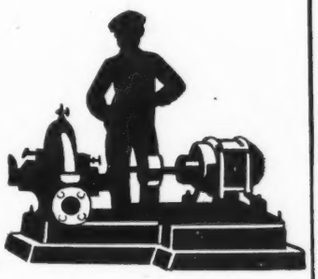

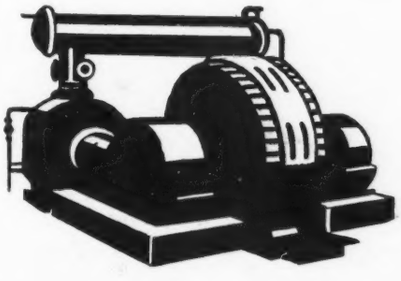

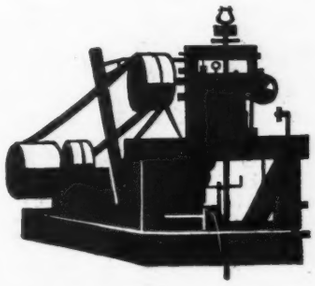

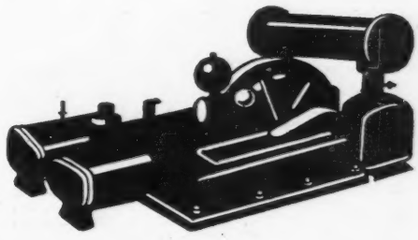

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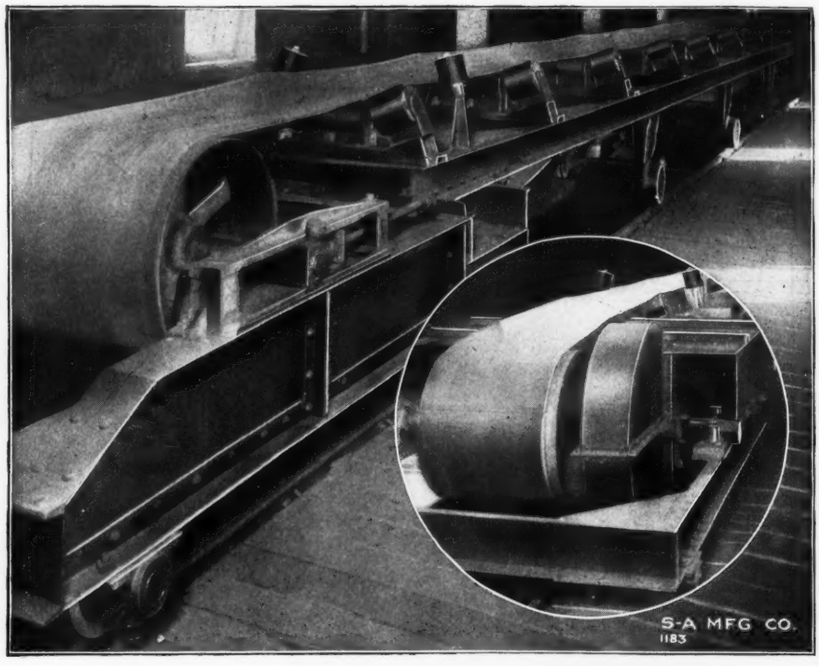


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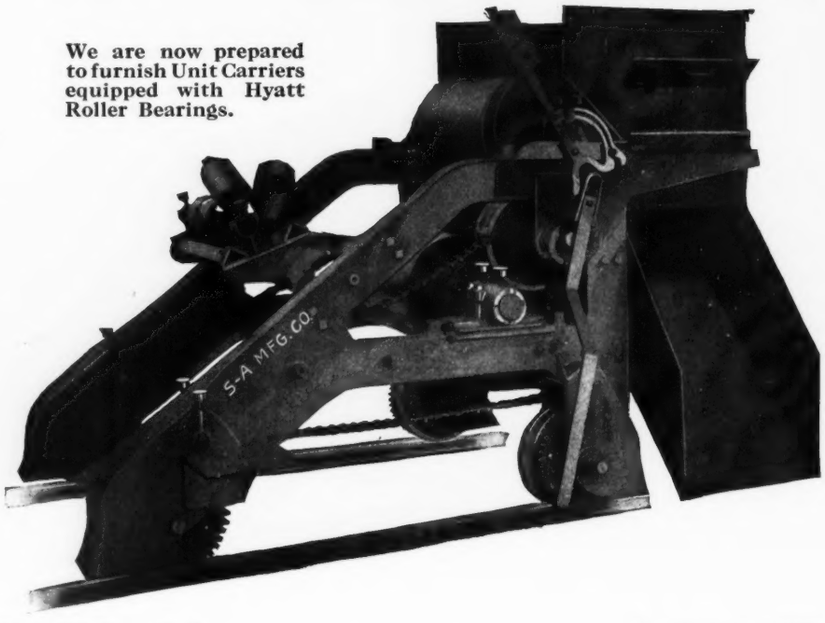


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# Commonsense of Gold Dredging

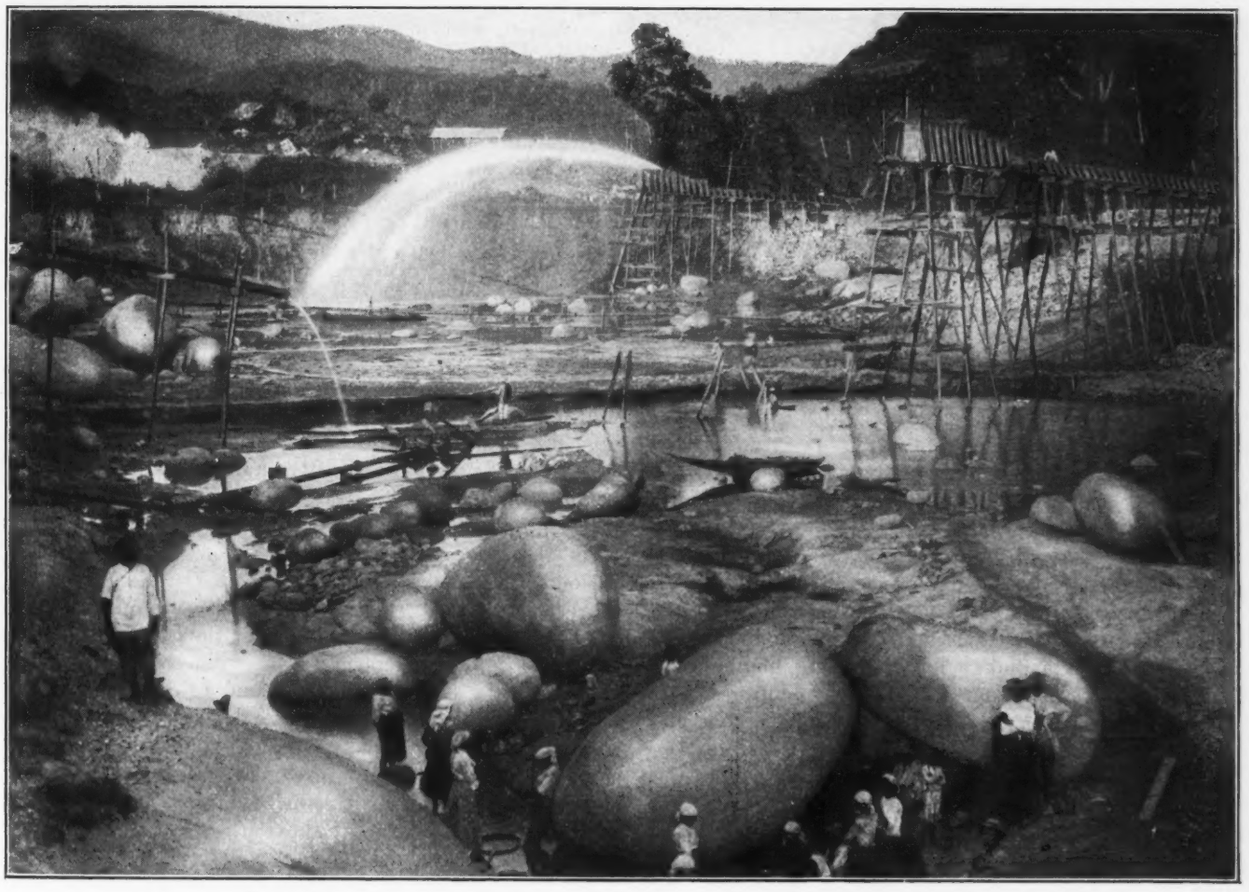
By A. C. Ludlum*

*SYNOPSIS—The essentials preliminary to a successful gold-dredging operation are concisely explained. Failures of the past largely due to lack of prospecting or unsuitable equipment.*

The right way to determine the desirability of a dredging project seems so simple that one often wonders how anyone can go wrong in this industry—that is, assuming that the promoter or prospector is serious and honest in his intentions and has no idea of promoting a wildcat scheme; and in this connection it is most satisfactory to note that there have been few wildcat companies promoted in the dredging field in recent years.

There have been failures in gold-dredging enterprises, and most of these might have been prevented if the proper steps had been taken in the beginning. There is still too much of a tendency to regard gold dredging in the light of a gamble, instead of applying to it conservative business methods, such as anyone should apply when contemplating an investment in a manufacturing or contracting business.

The prospector and promoter must be born optimists, but the investor should be the stabilizer, by applying the test of business and engineering methods to the project. The first step to be taken when considering any gold-dredging project is to secure the services of a competent engineer experienced in this particular line of work. This may not always prove as easy as it sounds. However, there are many channels through which the



LA CLARA MINES, COLOMBIA, WHERE GROUND IS PROFITABLY OPERATED WITH HYDRAULIC ELEVATORS—LARGE BOULDERS PRECLUDED DREDGING

*President, New York Engineering Co., 2 Rector St., New York.

name of a competent engineer can be secured. Frequently, the good nature of the editors of some of the mining journals are called upon, and their recommendations appear to prove reliable.

Often the engineer can observe conditions on the surface of the ground that will condemn the enterprise to failure, and thus can save the investor from further loss. It sometimes occurs that rough, hard bedrock will be visible in many places, or it can be readily seen that the gravel deposit is extremely shallow. Numerous boulders may be in evidence, so large as to make the cost of mining prohibitive. The prospector or promoter rarely ever seems to see any boulders larger than a man's head. This seems to be the typical manner of disposing of the boulder question in all placer ground. Large boulders are not always prohibitive to successful mining, but they do make for high operating costs and can be handled only by certain methods.

The accompanying view shows La Clara Mines, in Colombia, South America, which have been successfully operated for the last four or five years, notwithstanding the presence of enormous boulders; but it is doubtful whether this ground could be successfully handled by any other method than with the combination of giants and hydraulic elevators.

If, on the other hand, the physical conditions appear to be favorable for successful operations, it is then a comparatively simple matter to prospect the ground either by shafts or drill holes, or opencuts across the deposit may even sometimes be run. This work, which can be done at a comparatively small expense, will determine whether the ground is worthy of an exhaustive examination; in other words, a complete proving of the entire area may be made before the expensive dredging equipment is purchased.

### Paucity of Good Reference Literature

It is to be regretted that there is so little literature available to the average inquirer on gold dredging. Only a few books have been published on this subject, and none of recent authorship. However, the U. S. Bureau of Mines has now under way a publication on gold dredging, written by Charles Janin, which it is expected will be published in the near future. It is understood that this book will cover thoroughly the subject of gold dredging in the United States and will contain much valuable information. This would certainly be a great aid to those about to enter this line of work, as well as to those already engaged in dredging. Bulletin 121, issued by the Bureau of Mines, on the "History and Development of Gold Dredging in Montana," contains much valuable data and many interesting photographs. This booklet was written by Hennen Jennings, and contains a chapter on other placer-mining methods and operating costs, by Charles Janin.

Dredging, of course, is a comparatively new industry, dating back only about 20 years in this country. For the first few years, it "just growed," like Topsy, with no systematic development. This growth is well illustrated in the Bureau of Mines bulletin just cited. In this pamphlet is shown the struggle of a company during a number of years, with the expenditure of many thousands of dollars, in order to develop a successful dredge for the existing conditions.

Later, engineering ability came more fully into play in the dredging industry and today the American type of dredge may be said to be standardized, variation in the details of design and construction being made only to fit the particular conditions under which the dredge is to operate. With dredges standardized and with a number of responsible gold-dredge engineering and construction companies in the field, there is little need for anyone making a complete failure by securing the wrong type of dredge.

### Freak Equipments Responsible for Many Failures

Many failures were made in the earlier days by attempting to use the suction and the dipper types of dredges; also many peculiar engineering freaks were tried out and proved inefficient, such as sinking caissons, using divers in connection with suction dredges. Many so-called dry-land dredges, as well as the steam shovel, combined with sluicing apparatus, have also demonstrated their inefficiency and have caused failures, whereas with proper equipment a success might have been made. While there are many records of these failures, it is to be regretted that there is no compilation of them in any one particular form and therefore nothing to warn the average outside inquirer from these pitfalls. There is, however, less tendency nowadays for new companies to go wrong by attempting any of these experiments, which have demonstrated their failure in the past.

There is not only a standard type of successful dredge, but working costs have been accurately and closely determined, and many records of them are published in pamphlet form and in the various mining journals. Therefore there is little reason for any enterprise making a failure by underestimating their working costs.

Regarding the operating costs of different companies there is a strong tendency for the manager to overestimate or run up his yardage and to neglect many items that should properly be charged against the dredging costs. In determining this factor, one should not be guided by an isolated set of figures, but should endeavor to compare the costs over a period of years from a number of operating companies, and in this way perhaps secure a safer average.

Methods of prospecting have been developed and well established within the last few years. Sinking pits and shafts generally give good results. However, this work is usually expensive and generally slow and troublesome, owing to the presence of water in most placer ground or to the necessity of timbering the shafts. With the large amount of water flowing in from the bottom of the shaft, together with the running ground, it is most difficult to get an accurate sample of the ground. Owing to the troubles mentioned, the pits are often too few in number to determine accurately the actual mineral content of the ground in question.

The drilling method has generally been adopted, on account of the greater number of holes that can be sunk at a comparatively small cost. Contents can be accurately determined by this method, granting, of course, that the man in charge of the work is experienced and fully competent to make his estimates. The number of holes to be drilled in a certain area of ground cannot be determined beforehand; it will depend on whether the valuable metals or minerals appear to be generally and evenly distributed over a large area of ground or whether the deposit has a few rich pay channels or is generally spotty. For ordinary calculations one hole to the acre is considered fairly close prospecting work.

There are, today, well-known mining engineers with ample experience, who are thoroughly competent to determine the value of a gold-dredging project. This was not so a few years ago, as most of these engineers were obliged to gather their experience and knowledge in the active field of operations; few universities included this line of instruction in their course. Many failures of the earlier days would have been avoided if the experienced engineer in gold dredging had been available.

In considering a dredging enterprise, special attention must be given to amortization; it must be borne in mind that the initial cost of the ground and the dredge installation must be recovered before any real profit is earned, as the ground when dredged is practically useless. Attempts have been made to resoil or to render the ground useful after dredging, and this is now meeting with some success. In Australia it is compulsory by law, and the dredges are designed and their operations conducted so as to resoil all the dredged ground.

### Old Dredges Ordinarily of Little Value

The dredging equipment is of little value after a few years' operation, and especially if the ground is dredged out and useless. The dredging equipment in ordinary times will be worth little, though today, when the cost of all material is excessive and time of delivery greatly extended, a second-hand dredge may have a much higher value than otherwise—but these times are exceptional. The capital investment is a diminishing asset, probably disappearing during the operation of the enterprise. It is therefore necessary to prove up ample ground to cover the cost of the ground and the equipment and the operating expense, and then to leave a sufficient balance for a profit commensurate with the capital invested.

There is one factor that always remains the same in gold dredging; that is, the market value of the product. This is unchangeable, and the government always stands ready to buy the entire product at a fixed price. Another favorable point in gold dredging is the fact that the entire area can be prospected and all conditions predetermined, and there are less chances of the unexpected happening, such as the ore changing its character with depth or the vein faulting or pinching out, as in lode mining; in fact, it would seem that there is no one form of mining enterprise in which one needs to take less chance than in gold dredging. If the investor will only protect himself by securing the best possible talent in gold-dredge engineering before making any heavy commitments, success will be assured, or at least failure prevented.

## Jade Specimen from Jordansmühl

Among the noteworthy minerals shown for the first time at the recent New York meeting of the American Association for the Advancement of Science was the largest mass of jade ever mined in the world. This polished boulder, weighing 4710 lb., was placed on exhibition in the foyer of the Museum of Natural History, where it attracted great attention. It was discovered and mined, having the largest surface that has ever been polished, by Dr. George S. Kunz, an honorary curator of gems in the American Museum of Natural History. The story of the finding and the difficult problem of mining this huge mass of jade is interesting.

Heinrich Fisher, of the University of Freiburg, Germany, devoted almost his entire life to the study of jade. His consideration of the migration of races and of the relation and origin of the various jade objects throughout Europe led him to the conclusion that all jade objects found in Europe had an Asiatic origin, due to the migration of races. These views he presented in his book "Nephrit and Jadeit," published in 1875. Prof. A. B. Meyer, director of the Royal Anthropological Museum at Dresden, however proved later on that the presence of jade objects in Europe did not constitute an ethnological, but a chemical problem, although the greatest men of the period assailed this solution of a much-discussed theory.

The discovery of nephrite (jade) at Jordansmühl, southwest of Breslau, Silesia, Germany, by H. Traube in 1884, helped to confirm Professor Meyer's opinion. While engaged in working on the catalog of the collection of the late Heber R. Bishop, Dr. Kunz realized that in this great collection of jade and jadeite there was not a single specimen of jade with the matrix attached, and the same was found to be the case in the collections of every American and foreign museum. Since it was desirable to obtain such a specimen, Dr. Kunz decided to visit Jordansmühl, where nephrite had been found *in situ*. While abroad in 1899, this was made possible through the courtesy of Dr. C. F. Hintze, professor of mineralogy in the University of Breslau, whose assistant, Mr. Ulitzka, pointed out the exact location of the quarry. Since Dr. Kunz had but a single day at his disposal, Dr. Hintze was skeptical about being able to obtain the desired specimen.

However, several evidences of small pieces of nephrite were found at one side of the quarry. A great deposit of serpentine, due to alteration, was noticed, which was in the form of a low, bowl-shaped hill about 75 ft. high, and 2000 ft. long, and of which more than two-thirds had been removed. One large protuberance was found that was greenish in color, and upon breaking off a few splinters it was found to be nephrite. The mass was 7 ft. long, 2½ ft. wide and 1 ft. thick.

Through the kindness of Dr. Hintze the specimen was prepared for shipment. Although he was entitled to one-half of what was found, he preferred to have some polishing done for his museum rather than to take part of the jade, the result being that the entire mass is now in the American Museum of Natural History. The specimen, weighing 4710 lb., is believed to be the largest rock surface that has ever been polished. As it is large enough to furnish more than sufficient material to produce all the known objects of nephrite that have been found in Europe, it seems to prove conclusively that the prehistoric jade (nephrite) objects found in Europe need not necessarily have been brought there from the East.

Although both are included in the common designation "jade," nephrite and jadeite are mineralogically distinct, the former being a magnesium-calcium silicate and the latter a sodium-aluminum silicate, although they are more or less similar in general appearance. The source of jadeite today is Burma, where it is mined in considerable quantities for Chinese demand. It is notably harder than nephrite and ranges in specific gravity from 3.2 to 3.4, whereas the average for nephrite is but 2.95. Jadeite was first determined in 1863 by the French mineralogist Augustin Alexis Damour, who also determined an allied substance, chloramelanite, of greater density (3.4), darker hue and equal hardness.

# Depreciation and Measurement of Expired Outlay on Plant—I

By E. A. Erickson*

*SYNOPSIS—The success or failure of a mining enterprise may depend upon proper measurement of depreciation of productive plant. There can be no true profit until expired outlay is taken out of gross revenue. Depreciation is as much an operative expense as operative wages and should be distributed equitably over the economic life-period. Several methods of writing off depreciation are described. An itemized register of plant should be kept, separate from the ordinary financial ledgers.*

The fact that the ultimate success or failure of so many productive industries largely depends upon the adequate and proper recognition of the question of determining the best methods of measuring and providing for depreciation (which I call "outlay on productive plant") is not sufficiently realized; but the subject is constantly increasing in importance and has been gradually accentuated for years, possibly owing to the extension of joint-stock enterprise. I do not think it is too much to forecast that the whole question of the measurement of and due provision for depreciation of productive plant is now assuming such vast public importance that in the near future it will be necessary for the protection of the community at large, as well as the directors of public companies, to insist upon the use of more advanced and enlightened methods. The present happy-go-lucky do-as-you-please treatment of the subject has become intolerable.

No profit can exist until expired outlay on productive plant has been provided out of gross revenue.

One of the most vital matters connected with productive industries and trading concerns is the regular casting up, with substantial accuracy, of the annual net profit or loss that has resulted from the operations of each year; and unless a near approximation is made of the outlay on productive plant which has expired within each year, and value provided for out of gross revenue, no correct statement of profit or loss can be obtained. This does not seem to be altogether appreciated, if we may judge by some company reports and speeches to company shareholders—as well as by comments in the financial press—for it is often stated that the profit earned for the year is so much, out of which it is proposed to set aside such and such a sum for depreciation of plant and machinery.

It is startling to find what a large part of the capital of industrial undertakings of all kinds has been expended upon productive plant, which may be defined as consisting of all perishable material property owned by the undertaking other than that primarily intended for resale. Therefore, in the case of mining companies, it covers all buildings, plant, machinery, etc., other than land. All this capital invested in productive plant is invested in nothing more substantial than in payments made in advance on revenue account, which are presumably unexpired. Therefore the whole of such invested capital must come back ultimately out of gross revenue. About this there is no room for doubt; but where difference of opinion arises is, *when* is it to come back out of gross revenue? The extreme efficient economic life-period of any class of productive plant exceeds 100 years scarcely ever and 50 years rarely, the most common life-period being perhaps between 10 and 20 years.

Capital invested in the purchase of property of any kind primarily intended for re-sale does not come within our consideration, and any alteration in value, either up or down, which may take place in such assets—as value of orebodies—we are not concerned about, as these do not fall within the definition of productive plant. Although it is customary and prudent to set aside provisions of this kind, it should always be remembered that sums so set aside are true profits to the extent that all operative expenditure incurred in the process of earning them has been provided for. That such profits may come from an enterprise of an essentially and admittedly wasting character possessing unknown capacity does not divest them of the character of legal profits. On the other hand, no profits can emerge from an undertaking until each year's expired outlay on productive plant, being part of the operative industrial expenditure, has been taken out of gross revenue.

## Outlay On Productive Plant Compared With Other Advance Payments

To my mind money invested in productive plant, being nothing more than a payment made on revenue account in advance, may be compared with a premium in advance to cover, say, seven years' fire insurance. Such payment is sometimes made in order to secure better terms than can be obtained by paying an annual premium and there is in such cases no doubt that one-seventh of the sum paid would be charged to revenue account for each year until, at the end of the seventh year, the last installment of the original payment would come back out of gross revenue.

Such outlay as is under consideration should be treated in the same way. Therefore, if an undertaking lays out, say, $100,000—being part of its capital provided for the purpose—in the purchase of a certain kind of productive plant that (its competent and responsible officers declare), after taking into account the ravages of use and time and the probabilities of obsolescence, is likely to have an efficient economic life of 10 years, should not one tenth of $100,000 be taken out of gross revenue every year, as a proper charge for the use of that plant? I cannot follow the argument that, because a plant has been well maintained and is working more smoothly at the end than at the beginning of the first year of its life, no part of the original cost need come back out of the gross revenue of that first year. A man occupying a new house may have spent a large amount of money in making good unsuspected defects, and at the end of the first year of his occupancy the house may be much more suitable for occupation than it was at the beginning; but he has to pay the rent charge for his use of the house, which includes a full provision for the year's expired life.

*262 South Auburn St., Grass Valley, Calif.

Then again, if the productive plant purchased with this $100,000 had been completely used up and exhausted within an account period of one year, no one would suggest that the profit on the year's work could be ascertained until this $100,000 had come back out of revenue. Is, then, the fact that this outlay incurred on revenue account does not all expire within an exact account period of one year any reason for neglecting to refund, out of the year's gross revenue, the year's expired portion of the outlay? There is, of course, no particular virtue in a period of one year save that it is usual to ascertain operating results at the end of each 365 days.

### Depreciation Is An Operative Expense

The depreciation of productive plant occurring each year is as much an operative expense as operative wages. Productive plant has two very marked characteristics. One is that, other things remaining the same, it tends to fall in its present value (to a willing purchaser, having equal opportunities for employing it) in direct relation to the proportion of the economic life-period that has expired. The other marked characteristic is that the advantage or consideration obtained by the mining company, from the existence of its productive plant, is spread with approximate evenness over the whole period of the economic life of the plant. Therefore, in assessing this operative expense, the nearest approach to accuracy will be obtained by estimating the life of each class of productive plant, with due regard to all known facts as well as to probabilities, and basing the assessment upon this. The narrow view already mentioned, that if productive plant has been well maintained and works as well as ever depreciation may be omitted from operating expense or only provided out of surplus revenue when convenient, is a dangerous fallacy.

It will be found that the provision out of gross revenue of a fairly regular annual sum will amount, over a series of years, to no more than is now taken out of the gross revenue of any sound enterprise at irregular intervals for renewal of productive plant at or about the time the cost of these is actually incurred. The latter method often gives good ground for bitter complaint from those who happen to be holders of deferred-ordinary and lower-preference classes of shares at the time when a sudden call of this kind is made upon the balance of revenue account. In the case of holders of preference shares entitled to annual non-cumulative dividends the inaccurate assessment of annual profits arising out of this want of systematic policy often inflicts serious injury that can never be remedied.

### Methods of Writing Off Depreciation

I now propose to refer briefly to some of the methods in most general use for ascertaining and providing depreciation, the first being the simple one of charging to revenue account each year an equal fraction of the original cost of the particular kind of productive plant, based on its estimated efficient economic life. The cost of repairs and partial renewals is also charged to revenue account, as well as the cost of loose tools and utensils, subject to adjustment of stock values at the beginning and end of the year.

Another common practice is that of writing a percentage off the diminishing annual balance of cost of productive plant. This is a complicated method and leads to confusion. Thus it may be understood by directors that 10% is written off the plant, but this often means 10% of the diminishing balance of plant. It certainly leads to the belief in some minds that the cost will be written off in 10 years, although the fact is that it will take many years. If it was desired to write off the cost of productive plant in 10 years by means of a percentage off the diminishing balance, the percentage to be employed would be exceedingly heavy—at least 33⅓%—and I think this system of writing a percentage off the reducing balance is in most cases a bad one. Under this method the cost of repairs and partial renewals, as incurred each year, is of course charged to the revenue account of the year as well as adjusted cost of loose tools and utensils.

Table 1 will give an illustration of the effect of writing a percentage off the diminishing balance. The 10% rate off the diminishing balance will take many more than 10 years to write down the cost to a nominal amount, a balance of no less than $20,903 remaining at the end of the 10 years, although the original outlay of $60,000 has wholly expired.

TABLE I. WRITING OFF COST OF PLANT BY PERCENTAGE OFF ANNUAL BALANCE*

| | 33⅓% Off Diminishing Balance | 10% Off Diminishing Balance |
|---|---|---|
| First year | $60,000<br>—20,000 | $60,000<br>6,000 |
| Second year | 40,000<br>—13,330 | 54,000<br>—5,400 |
| Third year | 26,670<br>—8,890 | 48,600<br>—4,860 |
| Fourth year | 17,780<br>—5,930 | 43,740<br>—4,370 |
| Fifth year | 11,850<br>—3,950 | 39,370<br>—3,940 |
| Sixth year | 7,900<br>—2,630 | 35,430<br>—3,540 |
| Seventh year | 5,270<br>—1,760 | 31,890<br>—3,190 |
| Eighth year | 3,510<br>—1,170 | 28,700<br>—2,870 |
| Ninth year | 2,340<br>—780 | 25,830<br>—2,580 |
| Tenth year | 1,560<br>—520 | 23,250<br>—2,320 |
| | $1,040 | $20,930 |

* The sums deducted each year are slide-rule computations and so are approximations.

### Annuity Method of Writing off Depreciation

There are two methods that involve the use of interest. One of these is known as the annuity method, in which revenue is charged with equal annual sums sufficient to provide, at the expiration of the estimated life of the productive plant, an amount equal to the original cost thereof plus interest on the capital remaining invested therein for the time being. An amount equal to that part of these annual sums which represents interest is credited in annually diminishing amounts to the revenue account; so that, taking the difference between the constant amount debited for depreciation and diminishing amount credited to revenue each year as interest, the result is really to throw the increasing annual burden upon the revenue account as the productive plant comes nearer to the end of its life. I think this is a bad plan, especially in view of the fact that the cost of repairs and partial renewals incurred in connection with the productive plant may also increase as it goes on.

The effect of this method will be clearer by taking an imaginary case in which a productive plant, having an estimated life of 10 years, has cost $60,000 and is to be written off within that period on the annuity system

charging interest at 3% upon the diminishing balances. In this case the constant annual sums chargeable to revenue for expired outlay would amount to a total, during the 10 years, of $70,333.33, and the diminishing sums that would be credited to revenue in respect of interest amount to a total of $10,333.33.

TABLE 2. WRITING OFF COST OF PLANT BY THE ANNUITY METHOD

| | Expired Outlay Charged to Revenue | Interest Credited to Revenue | Actual Burden on the Year |
|---|---|---|---|
| First year | $7,033.33 | $1,800.00 | $5,233.33 |
| Second year | 7,033.33 | 1,650.15 | 5,383.18 |
| Third year | 7,033.33 | 1,490.32 | 5,543.01 |
| Fourth year | 7,033.33 | 1,311.00 | 5,722.33 |
| Fifth year | 7,033.33 | 1,141.00 | 5,892.33 |
| Sixth year | 7,033.33 | 960.00 | 6,073.33 |
| Seventh year | 7,033.33 | 790.32 | 6,243.01 |
| Eighth year | 7,033.33 | 590.16 | 6,443.17 |
| Ninth year | 7,033.33 | 400.00 | 6,633.33 |
| Tenth year | 7,033.33 | 200.35 | 6,832.98 |
| | $70,333.33 | $10,333.33 | $60,000.00 |

It will be noticed that by this method the actual burden upon revenue for the first year of the 10 is $5,233.33 and that it increases until for the last year of the 10 it is $6,832.98. The question in my mind is, why should interest on the capital invested in this productive plant, invested in the ordinary way of carrying on the business of the undertaking, be added to the provision for depreciation? I think the method complicates and obscures the actual facts and is by no means to be commended. The locking up of the capital for a time in productive plant is one of the incidents of the undertaking and is one of the purposes for which the capital is provided, and the whole profit resulting from various incidents of the business is the reward of the capital invested therein; and it appears that between the two methods—interest or no interest—the latter has much to commend it. If interest is to be calculated on portions of capital locked up from time to time in the course of carrying on the business, it would follow that it should be computed on an overdue debt. I fully appreciate the importance of interest on capital as a factor in ascertaining cost of production, but I do not think it should as a rule be added to the provision for depreciation, as is involved by the annuity method.

### Sinking-Fund Method Described

I will dwell briefly on another method, known as the sinking-fund method. In this case the equal annual sums charged to profit-and-loss account amount to $5,233.33, or a total for the 10 years of $52,333.33, and the total interest earned on the investment in securities, outside of the business amount to $7,667.67, being altogether $60,000. By this method $7,666.67, the total annual increasing interest from the investment of the money gradually released from the original cost of the productive plant, is diverted from the credit side of the revenue account (where it ought to appear) and is applied to the purpose of helping to accumulate, by the end of the economic life of the productive plant, the sum of $60,000 (original cost); the revenue account having in the meantime been charged with a less sum by $7,666.67 than the actual provision which has been made by the aid of this method; so that the true effect is the omission from both sides of the revenue account, under the head of "depreciation" on the one side and of "interest" on the other side, of annually increasing sums amounting during the 10 years to $7,667.67.

The fact that annual installments of the original cost are taken back out of each year's gross revenue does not diminish the extent of the productive plant offered for the use of the company. In all probability the installments taken out of revenue each year are re-invested in renewing productive plant; but whether this is so or not, consideration of interest involved in the annuity method or of discount involved in the sinking-fund method should not be allowed to increase or decrease the annual amount taken back out of revenue in consideration of continuous offer of service on the part of that which is a limited, and in a very marked degree regularly expiring, economic life.

### Classified Record of Capital Outlay on Productive Plant

It will appear from what has been said before that I believe the best method of measuring expired outlay on productive plant is to base this upon the estimated efficient economic life of each class of such productive plant; and, in order to enable this to be done, the first requirement is to secure a systematic record under suitable heads showing year of purchase and the original cost. This is too often neglected, outlay on productive plant of a varying nature and varying life being all recorded and mixed up together in the books.

The factors to be taken into account in estimating efficient economic life of each class of productive plant—in a large concern such classes may extend to hundreds—are use, time and likelihood of supersession by improved inventions and appliances of a similar nature. Careful consideration must be given to the question of residual value. The most important factor is time; because, whether productive plant is used much or little, it is apt to decrease in value year by year. Sometimes this decrease is even more marked when it is not in use or is only used intermittently, than when it is fully employed. The question of probable supersession owing to improvements, sometimes called obsolescence, is much more difficult to determine.

From a clerical point of view there would be no difficulty in keeping a register of plant, even if there are hundreds of different classes of productive plant—it simply requires the provision of proper equipment.

A company might declare the economic life of each of its various classes of plant as being any period it pleased from two to 100 years; but if a motor truck was declared to have a life of 100 years, so that only 1% of the original outlay on this would have to be provided out of revenue each year, such a course would stand self-condemned, and certainly no engineer or officer of the company would be found to certify such a statement.

[*To be concluded.*]

## Chilean Nitrate Industry

A recent issue of *Commerce Reports*, of the United States Department of Commerce, gives the nitrate production for December, 1916, as 5,326,823 quintals (of approximately 100 lb.) and the amount exported as 6,314,621 quintals. The prices for prompt delivery vary from $2.34 to $2.29 per quintal, giving a value for exports for the month of about $14,600,000. Practically the whole of the production for the next six months is already contracted for.

The average *oficina* handles about 800 tons of *caliche*, or nitrate-bearing rock, per day. It is reported that the Compañia de Salitres de Antofagasta is about to erect a new treatment plant of unusual capacity.

# A Chilean Pocket Gold Mine

By E. David Pope*

*SYNOPSIS—In 1911 the discovery of a rich gold pocket at Putu created much excitement. The deposit was of limited extent and was soon worked out. The veins were cut off by numerous faults. This isolated patch of rich gold ore in a country full of barren quartz veins is of special interest. Some of the slightly mineralized quartz vein was crushed with a steam stamp and the gold recovered by amalgamation.*

Early in the month of September, 1911, the whole of Chile was startled by tales of a sensational gold discovery at the village of Putu, near the fashionable bathing place of Constitución. Fabulous stories were told of the rich gold encountered there, and the jewelers' shop windows in Santiago were daily surrounded by a dreaming crowd eyeing the beautiful specimens exhibited behind the glass. And the specimens were certainly beautiful—a white, milky quartz held together by a cement of crystalline gold (940 fine) of an exceptionally brilliant yellow color. The fever grew, and it was found necessary to send a quarter squadron of *carabineros* to the village to keep order. All Chile from the president to the humblest *roto* miner were dreaming of the future with a golden Chile.

All has now been dead several years, and the mystery that surrounded the whole of the operations has never been cleared up. The discovery occurred near the village of Putu, 17 km. north of the port of Constitución, department of Talia, and about 300 km. south of Valparaiso. The initial stages of the episode have been dealt with,[1] but I will briefly repeat what took place at the discovery.

A Chilean laborer, in the employ of a man named Juan Rodriquez, had been sent to the site of the vein to get large white stones known to exist there, with which to pave a new cattle shed. He tried to lift a stone about 18 in. diameter into the cart, but he could not move it. Neither could it be broken by hammers with any ease. Being attracted by the yellow metal binding the stones, he showed it to Rodriquez, who thought it was copper, but still was shrewd enough to keep the stones. No one in the village of Putu knew native gold when he saw it, and people had actually built a hut at the foot of the outcrop with stones heavy with free gold. Stones carrying free gold were found in a pear tree, where they had been thrown to get down the fruit.

In the first few days of the rush, after the discovery (for Rodriquez showed his stones to someone who knew gold when he saw it), about £6000 worth of gold was collected off the slope of the hill for a distance of more than 50 m.

After considerable fighting for claims, legal juggling, etc., Rodriquez received £20,000 in cash in a week, and under the extremely able leadership of Senor Artuso Alexandri, a company was formed called *Compania Orera se Putu*, owning about 300 acres of claims with a capital of £85,000, of which £8500 was working capital.

Trouble began soon because the man in charge could find no vein, and so great was the disappointment that $1000 shares were being given away. Indeed, even today one frequently hears people say that no vein was ever found. Later these shares reached a value of $2200.

The difficulty arose because the vein thinned out to a stringer at the outcrop, which, where cut, was barren. A pit sunk at this point, but on the wrong side of a fault, was actually within 5 cm. of the rich pocket. Standing in this pit, the company's engineer assured the crestfallen directors that the gold was a placer occurrence, and that the vein was a barren one, having nothing to do with the quartz boulders found on the surface. However, the directors, headed by Senor Alexandri, tried again. They made an offer of 400 of the $1000 shares to Senor Alfredo Oralle, an elderly silver-mining man from the northern fields, if he could find gold in vein form.

Senor Oralle went wrong at first, but finally made a fortunate crosscut and after driving two meters ran into

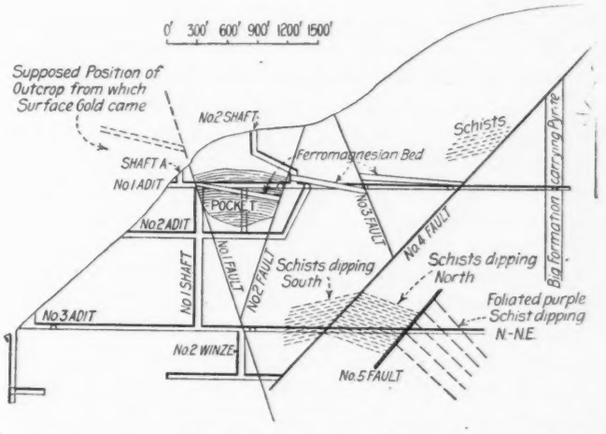



FIG. 1. LONGITUDINAL SECTION OF SANTA ANA MINE

what proved to be the heart of the pocket on what is known as the Santa Ana vein. Shortly after this Senor Aralle retired, previously having sold his shares for $2000. A young mining engineer was then put in charge, and he had the doubtful pleasure of proving in six months that all the gold in that particular mine was contained in one pocket about 25 m. long, 30 cm. wide and 5 m. vertical depth.

The coastal district in which the Putu mine is situated is formed of schists and other altered rocks lying on a granitic basal formation which constitutes the highland behind. This is the favorable country rock[2] carrying the gold deposits of Chile.

The schists immediately surrounding the mine all lie at a flat angle and dip in various directions, due to much faulting. A feature is the frequent occurrence of lenses and small masses of a glassy quartz. In the Putu mine all the outer portion of the hill is a decomposed mica

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[1] "Gold Discovery at Putu, Chile," by Mark R. Lamb. "Eng. and Min. Journ.," Dec. 2, 1911.

[2] "Mining Magazine," London, June, 1915.

and schist, the other minerals being entirely indistinguishable. The mica is mostly biotite, but some muscovite and a little lepidolite were found. In the deepest workings a hard purple schist, very foliated, was encountered, carrying much lepidolite, which gave it a silky appearance. On the surface considerable float granite was found, and everywhere was quartz broken out of the lenses in the schist.

The whole area is deeply covered with drift sand from the seashore, and much scrub still further impedes effective prospecting. A characteristic of the district is the great number of faults which run in all directions and have different effects on the country they cover. However, one series of parallel dikes, the most persistent, runs approximately east and west and dips 45° south. There is much clay, and the fault width reaches to 4 m. in one case. This fault, No. 4 in the mine, is traceable for 2 km.

The first work was done at the pit *A*, Fig. 1, on the narrow outcrop, immediately under some high-grade large stones found on the surface. (No valuable float was found higher up the hill.) The vein at a depth of 5 m. was 40 cm. wide, hard, glassy and almost barren, inclosed in walls of soft, decomposed biotite schist dipping slightly to the south.

### Loss of Veins by Faulting

On driving north 2 m. into the hill from the foot of the pit, the No. 1 fault was cut and the vein lost, due to its turning farther east, while a barren stringer extended directly on. This stringer was followed north. A crosscut west from the 20-m. mark passed through two more barren stringers, on which sufficient work was done to prove them. Turning east from the 20-m. mark, the Santa Ana vein was again met, carrying large lumps and stringers of native gold in a broken area about 1 m. wide; turning south along this vein, it was found to return to the bottom of pit *A*. All this 20 m. contained rich specimen ore. Going north, the high-grade ore continued another 5 m. until fault No. 2 was encountered, striking parallel to fault No. 1, but dipping in the opposite direction. Beyond this fault no payable gold was ever found, and although considerable work was done in all directions, no further ore was exposed.

The vein continued another 40 m., however, getting wider and finally reached a width of 1 m. It was completely lost at No. 4 fault. Beyond this major fault the Santa Ana vein could not be found, but a brecciated formation 10 m. wide was cut, running east and west, which carried much fine-grained pyrite and marcasite and assayed 100 grams of silver and 5 grams of gold per ton. This formation did not outcrop, being cut off by No. 4 fault before it reached the surface.

An attempt was made to find this last mineralized body on the lower workings, but a second major fault, No. 5, parallel to No. 4, was encountered, and the country rock on its northern side was found to be a very hard lepidolite schist, which made driving slow and costly, and to my knowledge the vein was never reached. The Santa Ana vein was well formed in the lower, or No. 3, adit, but carried no gold to speak of and was completely lost at its meeting with No. 4 fault.

Many other veins were encountered in the crosscuts and drives, but none carried pay ore. A most noticeable feature in the rich pocket in the vein is an almost horizontal formation of peculiar structure which is interbedded with the schist. This bed, which has an average thickness of 2 m., is also cut off at the No. 4 fault. Its composition varied greatly. At its outcrop it consisted of a massive ferromagnesian mineral having many vugs lined with crystals of silica. This was the prevailing structure, but where the Santa Ana vein cut it, in the rich section of the vein, it was found to take the form of cherty quartz, mixed with much brown sand, and the large lumps were very hard and spherical. The larger pieces carried cubical pyrite crystals, which on concentration, assayed 40 grams of gold per ton.

At its intersection with the rich portion of the vein, this bed had first rolled upward, then been faulted downward as shown in Fig. 2, and thus had an actual contact of 5 m. with the vein. It was only where this bed cut the Santa Ana vein, and only the Santa Ana, and also only where it took the cherty form, that pay ore was found. Undoubtedly the surface float had come from the weathered portion of the vein south of the No. 1 fault, which had been entirely eroded, as indicated by the dotted lines in the longitudinal section. The fact that heavy gold was formed at this contact led the engineer, who had intimate knowledge of the Gympie field in Queensland, to hope that other veins meeting this bed would also carry gold, but although the ferromagnesian variety of the bed was common, no more quartzose variety could be found, and apparently the ferromagnesian form was not of any value from an enriching point of view. This peculiar isolated patch of rich gold ore in a country full of quartz veins, possessing identical formation conditions as that of the Santa Ana, has always puzzled me, and I would be interested to learn if other analogous cases are known.

FIG. 2. SHOWING BED FAULTED AT RICH PORTION OF VEIN

As an example of the kind of ore obtained from the pocket, one parcel of rock taken directly from the vein gave 8 kg. of gold from 38 kg. of stone, and altogether over £10,000 of gold was taken out of one pocket containing only about 50 cubits of ore averaging £80 per ton. The gold was highly crystalline, massive and very pure; one shipment averaged 965 fine. The occurrence of the gold in the quartz seemed an ideal illustration of the "gel" formation theory.

The schist at Putu was soft and yet stood well, greatly facilitating cheap development work. Most of it could be mined with a pick. The average cost per meter of a drive 2 m. by 90 cm. was £1, 10s. This included dynamite and tool sharpening, but not tramming. In the short

time of six months, 700 m. of exploration work was done with a force that never exceeded 30 miners and trammers all told.

With the idea of treating this ore and in the hope of finding sufficient 10-gm. ore to supply 10 tons per day, a Tremain steam stamp outfit, with a 7-ft.x3-ft. 6-in. apron plate and Overstrom table was installed. The stamp crushed about 250 tons of hard quartz ore at the rate of 13 tons per 24 hr. It worked well and smoothly and, in a country where fuel is cheap, is a really valuable plant for prospectors and developing mines. This plant, including all charges, cost £800 erected and ready to run. It was ordered by cable on Aug. 29, and was running on Dec. 28 of the same year, which is rapid work for Chile. There is only one trouble to be found by the novice in running these steam stamps, and that is due to the packing blowing out in the valve. This could be overcome by increasing the width of metal between the different steam passages, thus giving a wider seat to the packing.

The Putu company stopped operations in April, 1913, having had a life of 18 months. It is still an after-dinner topic in mining circles in Chile, and the richness increases every time the story is told.

## British Attitude on Taxation of Mines

WASHINGTON CORRESPONDENCE

It is a matter of common knowledge to mining men that London is the home of many mining enterprises whose operations cover many continents. It is also a well-known fact that taxation of mining property, if carried to the extreme, will prove fatal, and perhaps more swiftly than to any other industry. With these facts before us there may be some significance as well as interest for American mining men in the cogent remarks of a British metallurgical authority at the time the British government considered increased taxation of all mining interests situated within her domains. He said:

The City of London has been for years *par excellence* the financial center of the mining world. From no other center has there been such an amount of speculative money available. In no other center has so much capital at all times been available; in no other center has there been so much information ready to hand or so many facilities to assist speculative enterprises. Look at the London Stock Exchange. Consider the list of mining companies in London and the vast number of persons throughout Great Britain who hold shares in mining ventures throughout the world. Of the world's gold 70% came from or was owned in the British Empire, probably 60% of the lead, 30% of the zinc, 30% of the copper and 80% of the tin. The diamond mines, of course, are a British monopoly. I believe I have counted about 2500 British mining companies which were actually producing metal on a considerable scale in practically all the metalliferous regions of the world.

Now comes the war and the war taxation. A mine is not a farm or a factory. If you tax its income you are also taxing its capital. A mine with ten years to run which is only paying 10% is paying no interest at all to the man who buys its shares at par. The burden, therefore, of 4's income tax works intolerable hardship upon the mining company. The life of every mine is limited, and every dividend is therefore a part return of capital. Consequently in this industry alone is the return of capital subject to income tax. Great numbers of mining companies whose head offices are in London are really owned in the colonies and abroad. The convenience of a head office in London, with a board of directors and a staff of clerks, was very great, and a 5% income tax would in most cases be endured. These head offices are very profitable to London; they disburse from £1000 to £5000 per annum each in management expenses to British citizens. But the new burdens—unless speedy steps are taken to relieve the foreigner and to meet the special case of mines whose profits, as I have shown, are in quite a distinct category—these new burdens will cause such a flight of mining companies from London as the government, I am sure, has never dreamed of. Neither the colonial nor the foreign enterprises will hesitate to transfer their head offices to countries where they will escape confiscatory taxation.

I know of very important enterprises in foreign countries which are certain to be sold or, if not, to be transferred from London to the United States, or to Holland, or to India, or to Australia, unless, as I have said, very speedy action is taken to remedy the evil from which they are determined to escape. Prohibitive legislation is impossible, for capital will run like water from countries where it is harshly treated. The city may only begin to appreciate the loss when it is too late.

## Military Mapping by the United States Geological Survey

As a result of coöperation between the United States Geological Survey and the War Department through the Topographic Branch of the Survey, which has had to meet special requirements of the Army, a Division of Military Surveys has been created. Glenn S. Smith, who is credited with much that has already been accomplished in this special work, is in charge as topographic engineer.

The special order issued by the Department concerning this adds: "In whatever degree the topographic survey of any area is intended to meet the needs of the War Department, the field and office work will be administered directly by the chief of the division under which that area comes geographically, but the supervision of the technical work in so far as it is planned to meet military requirements will be under the chief of the Division of Military Surveys. It is believed that this division of responsibility is definite enough to continue the present plan of efficient administration and also to provide for the specialization necessary in much of the mapping planned and indeed already in progress. The special map data desired by the War Department will thus be collected under one plan and by the same methods for certain areas, whether on the Atlantic or Pacific coast, but without affecting the general administration of the work within any division."

**Few Deposits of High-Grade Amorphous Graphite** have been discovered. Chosen and Mexico are perhaps the only two countries that produce it in appreciable quantities. The Mexican deposit is owned and operated by the United States Graphite Co., of Saginaw, Mich. The ore is conveyed from the mine 20 mi. to the railroad by mule teams and shipped from Torres, in the State of Sonora, about 150 mi. from the border. There are other deposits in the country but, according to W. L. Whitney, of the United States Graphite Co., none is of sufficiently good quality to justify operation.

# Lubrication of Rock Drills

By Charles C. Phelps*

Rock drills are generally regarded as the most "rough and ready" tools in use. They can withstand almost any abuse. As a consequence many drill runners believe that any oil is good enough for lubricating a drill. While it is true that drills will run with almost any kind of oil, it is beyond question that the best results and the least repair costs are obtained only by employing lubricants especially suited to the service. For steam-operated drills a good quality heavy-body steam cylinder oil is generally found to be most suitable. For air-operated drills, the usual advice is to employ a light or medium-body oil of good quality; however, recent experiments have shown that liquid grease is much better suited for air-operated drills under many conditions of service. This lubricant has been used successfully with both hammer and piston drills, mounted and unmounted types. Liquid grease is particularly valuable for water

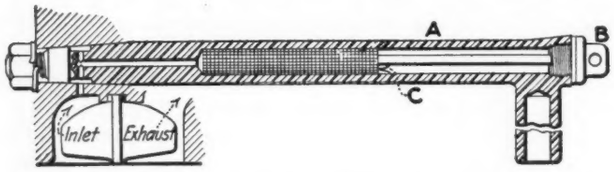


FIG. 1. HANDLE OF A STOPING DRILL USED AS AN OIL RESERVOIR

machines, like the Leyner-Ingersoll, water jackhamer and water stopehamer, for the reason that it is not washed out by the water as readily as oil is.

Liquid grease is a substance that has the appearance of oil and flows similarly, but otherwise has the characteristics and properties of grease. It may be handled in an ordinary oil can and will flow freely through the automatic lubricators on drills. It is made by several of the oil companies. It would be impractical to list here all the various brands which are suitable for air-operated drills, but Texaco transmission grease No. 2, Polarine liquid grease, Keystone liquid grease No. 5 and No. 6 have been found to give satisfactory results.

The method of feeding is fully as important as the kind of lubricant used. Insufficient lubrication results in slower drilling speed, power wasted in friction, and a more rapid wearing out of parts with consequent higher repair expense. Lubricating too liberally simply increases the oil bill without making any appreciable gain in the operation of the drill. Too often, the matter of lubrication is left to the discretion of the drill runner, who either feeds the oil too liberally or forgets to replenish the supply until the drill runs dry and, by its poor performance, reminds him that it is time to relubricate. One of the best ways to determine whether a hammer drill is getting sufficient lubricant is to notice, when changing steels, whether the shank has oil on it. An operator soon learns to tell when a drill needs lubricant by the dry appearance of the steel shank.

The more modern drills are provided with means for automatic lubrication—features of the greatest practical value. Sometimes the oiling device is an integral part of the drill, and sometimes it is a separate part.

Fig. 1 shows the arrangement for oiling employed with a typical stoping drill. The oil well is in the handle used for rotating the stoper. The hollow handle *A* fits in a taper hole in the valve chest. In the handle is a porous plug *C*, beyond which is the oil chamber. Before starting the machine, oil plug *B* is removed and the chamber in the handle filled with liquid grease. As the machine runs, the pulsations of the air in the supply chamber of the chest draw the oil through the porous plug into the machine. Means are provided to exhaust any pressure in the handle after the air is shut off without drawing the oil out of the chamber. The porous plug serves the double purpose of regulating the flow of oil and straining out any dirt or grit it may contain. A somewhat similar arrangement is used with jackhamers, but in these drills the oil chamber is placed in the side of the cylinder.

If a drill does not embody an oiling device as an integral part of its construction, it can be fitted easily with a special oiler, of which there are several types on the market. In fact, many modern drills are designed to be used with oilers of the external type.

Fig. 2 shows a satisfactory type of external oiler which embodies an oil reservoir of about a half-pint capacity. It is made of malleable iron with a taper plug valve, and is intended for use with either air- or

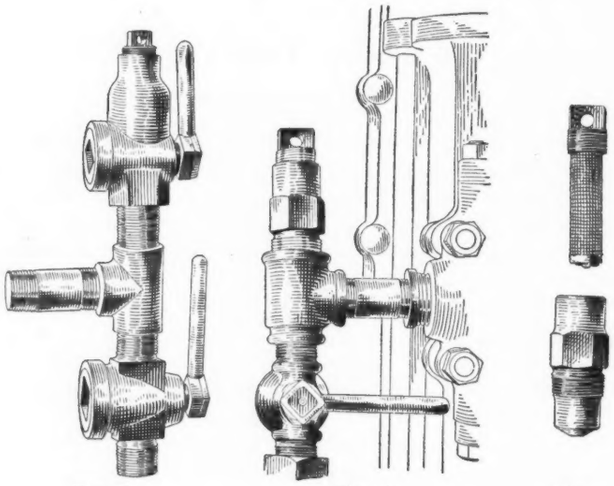

Fig. 2 Fig. 3 Fig. 4

EXTERNAL OILERS AND LUBRICATING CARTRIDGE

steam-operated piston drills. The reservoir is closed with a screw plug. The taper plug has two cups on opposite sides, each holding about a teaspoonful of oil. One cup is always in communication with the reservoir and filled. A half-turn of the handle empties this cup into the supply passage to the drill, and the oil is carried as a spray into the machine. The other cup is filled ready for another turn of the handle. The reservoir holds enough oil for a half-shift's run, and the handle should be thrown about every 5 to 10 ft. of drilling. The right amount of oil is admitted each time, with no loss of oil or pressure.

Another type of oiler, Fig. 3, is designed to take the responsibility for proper drill lubrication out of the hands of the runner and place it entirely in those of the foreman. It operates by the pulsations of air in the supply pipe near the drill, due to the alternating reversals of the drill piston, and from the nature of its operation has been aptly named the "Heart Beat" oiler. It consists of an oiler body containing a plug carrying a cartridge of wire gauze and an absorbent

*Ingersoll-Rand Co., 11 Broadway, New York.

material (Fig. 4). The body is screwed into a tee, to the branch of which the drill is connected, the oiler coming above the tee and the throttle.

The cartridges are carried in boxes. Three cartridges will suffice for one shift. The drill runner going on shift gets three cartridges from the foreman, and coming off shift, he returns three dry cartridges, which are dropped in a tub of oil and recharged. There is no way of drying the cartridges except by using them in the drill, and the return of dry cartridges is proof the drill has been properly oiled. The oil is not wasted—blown out without doing useful work—but is fed slowly and used to best advantage.

The "Heart Beat" oiler not only enforces proper lubrication of the drill, thus reducing its wear and increasing its capacity, but also economizes lubricant. This type of oiler is intended only for use with air-operated piston drills.

Sometimes drill runners introduce oil through the hose, pouring it in before connecting the drill line to the pressure main, thereby saving themselves the trouble of unscrewing the oil plugs of the drill. This practice cannot be condemned too emphatically, for the oil rapidly destroys the rubber lining used in ordinary hose, and furthermore, it carries into the drill any particles of dirt that may have lodged in the hose.

The remaining important point to be considered in connection with lubrication pertains to grit, dirt and other foreign matter. It is scarcely necessary to mention that the working parts of the drill should be cleaned frequently, preferably with kerosene, and kept well oiled or greased while standing idle.

Dirt must be prevented from entering the drill either with the lubricant or with the compressed air. The former point is taken care of by using a good quality of liquid grease only or oil free from impurities and keeping the supply in a closed vessel. A little grit will do a lot of damage in cutting out cylinders, valves and rotation parts. Small particles of grit and dust pass through the hose, and these must be removed before entering the drill, usually, by an air strainer or filter of some type placed as close to the drill inlet as practicable.

Fig. 5 shows the details of a strainer placed within a stoping drill. This strainer consists of a cup-shaped disk of perforated metal held in position back of the throttle valve by a coiled spring. It has been objected by some that a strainer such as this will result in loss of air pressure. However, tests at various pressures have shown that no reduction in air consumption or loss of power occurs through its use. If the work done by the machine falls off, it is an indication that the strainer is clogged with dirt and needs cleaning. It will be noticed that the air inlet is enlarged at the strainer, permitting an unrestricted flow of air.

Fig. 6 shows another type of strainer, which is principally intended for use on stope drills. The straining medium consists of a piece of perforated metal rolled into the form of a tube. The connection of which this type of strainer is a part should always remain attached to the valve chest when the machine is disconnected from the pressure line to prevent dust from entering the tool while lying idle. Dirt collects on the inside of the straining tube and may be easily removed from time to time by taking the device off the drill and blowing air through it from the end opposite that into which air ordinarily enters. Fig. 7 shows a sectional view of an angle filter, which forms a part of the standard equipment of certain water drills.

The straining medium in the filter illustrated in Fig. 7 consists of a tube of brass wire cloth through which the air must pass to enter the machine. The area through this tube is greatly in excess of the area of the inlet and outlet passages, which insures a free flow of air.

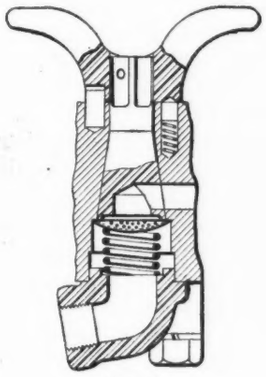

Fig. 5

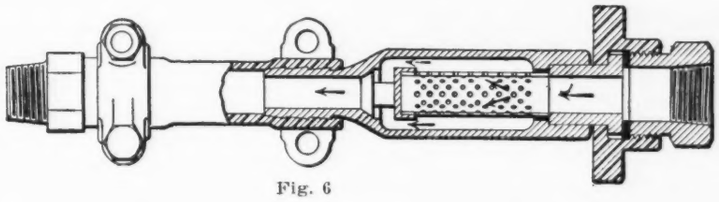

Fig. 6

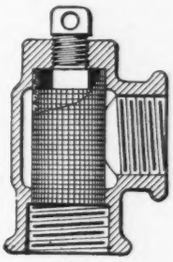

Fig. 7

THREE TYPES OF OIL STRAINERS IN USE WITH WATER DRILLS

## Swedish Iron and Steel Output

Official returns of the Swedish iron and steel industry, according to *Iron Age,* Feb. 22, 1917, give the pig-iron output in 1915 at 760,701 metric tons, of which 35,075 tons was made in electric furnaces. Of the total, 419,686 tons was openhearth iron, 161,835 tons forge iron, 121,476 tons bessemer iron and 45,931 tons foundry iron. Furnaces in blast were 120, with an average output of 21.4 tons per day. Charcoal was almost exclusively the fuel, 674,360 tons having been used.

The output of wrought-iron blooms was 119,629 tons; besemer-steel ingots, 91,070 tons; openhearth steel, 503,766 tons; crucible steel, 3395 tons; electric steel, 2187 tons, and blister steel, 148 tons. The forged iron and steel production was 42,403 tons and the rolled iron and steel 830,167 tons.

Ore output included 7607 tons of manganese ore, 55,937 tons of zinc ore, 1642 tons of nickel ore and 76,324 tons of pyrites.

# Sodium-Sulphide Precipitation at Nipissing*

Before the war aluminum dust cost 33.82c. per lb. and caustic soad 2.11c. per lb. delivered at the Nipissing mine. This was used in the precipitation process described by E. M. Hamilton in the *Journal* of May 10, 1913. In May, 1916, the lowest price at which aluminum dust could be bought was 90c. per lb. and caustic soda had risen to 5.77c. per lb. At these prices the increased cost for chemicals used at this mill would have amounted to about $33,000 per year. This condition compelled the immediate adoption of a substitute. Sodium sulphide appeared to present the most promising solution of the difficulty, and experiments were carried out and were so successful that in June, 1916, the process was adopted.

Two objections are apparent in the use of sodium sulphide for precipitation—the first, that complete precipitation could not be obtained without using an accessory reagent; and the second, the difficulty of producing silver sulphide instead of metallic silver. In regard to the first point it was found that the solution could be precipitated to 0.2 oz. silver without an excess of sodium sulphide in the barren solution. The second objection was met by converting the silver sulphide to bullion by using the same principle employed in the desulphurization of the raw ore before it is sent to the cyanide treatment. This principle is that the various sulphides and combinations of silver are decomposed by contact with metallic aluminum in a caustic-soda solution. This is an important feature of the process, since it gives fine bullion as a product at small cost.

## Previous Sulphide-Precipitation Methods

In the former days of the sodium-hyposulphite process, before silver ores were treated by cyanide, the treatment and marketing of the sulphides produced was the principal obstacle. Various methods were devised for the treatment of this product at the plant, but they were costly and unsatisfactory. The best of them, however, was the Dewey-Walter process, in use at the Marsac mill, Park City, Utah. The reactions involved in this process are as follows:

$$2NaCy_2 + Na_2S = Ag_2S + 4\ NaCy$$

$$2Al + 5NaOH + 3Ag_2S = Na_2Al_2O_4 + 6Ag + 3NaHS + H_2O.$$

$$2Al + 8NaOH + 3Ag_2S = Na_2Al_2O_4 + 3Na_2S + 6Ag + 4H_2O$$

The commercial sodium sulphide used is supposed to be $Na_2S + 9H_2O$, which would be equivalent to 32.5% $Na_2S$. A concentrated form of sodium sulphide can be had, which promises to work up cheaper than the ordinary brass.

By the use of the equation it is found that it would require 0.076 lb. avoirdupois of commercial sodium sulphide to precipitate ont troy ounce of silver. In practice the amount required is 0.12 lb. In the desulphurizing operation one troy ounce of silver requires 0.021 lb. of NaOH. This would be 0.028 lb. of commercial caustic soda carrying 76% NaOH. If an excess of caustic is present in the operation, the reaction in the third equation may take place, in which case 0.034 lb. of NaOH is used for each ounce of silver desulphurized. To prevent this taking place, the amount of silver present in the charge to be desulphurized is estimated as closely as possible and 0.03 lb. of commercial caustic soda is added for each ounce of silver contained. The theoretical amount of aluminum necessary to desulphurize one ounce of silver is 0.0057 lb. avoirdupois, the amount actually used in practice being 0.006 lb.

## Practical Details of the Process

The procedure is carried out by dissolving the sodium sulphide in an iron barrel into which is flowing constantly a small stream of barren solution from the filter press. The barrel is divided by a vertical partition reaching nearly to the bottom. There is an excess of sodium sulphide in the barrel, and the overflow pipe of the opposite side of the partition from the inflow carries the precipitant to a tank, where it is agitated with pregnant solution, which is then pumped to the Merrill filter press. The amount of sodium sulphide added is regulated by a boy, who constantly tests the inflowing barren solution with pregnant solution and with sodium sulphides to determine whether there is an excess of sodium sulphide or unprecipitated silver present in the discharge from the press. The amount of barren solution coming into the barrel, and consequently the overflow of sodium sulphide, is regulated by a valve on the intake pipe in front of the operator. This operation could be carried out more precisely, perhaps, by precipitating a tankful at a time, but in our case the tank capacity was not available. The solution from the filter press is aërated thoroughly in the barren-solution tank by air lift and a large circulating pump, the object being to oxidize any sodium sulphide should there happen to be a slight excess in the precipitated solution. The shiftman always tests the solution for soluble sulphide before running it to the treatment tank, and no bad effect has been noticed from this cause. Aëration is used in preference to lead salt, as lead has a bad effect on extraction. A tankful of sulphide precipitates contains 25,000 oz. of silver. This is drawn into a tank, and the proper amount of caustic soda is added, 0.03 lb. for each ounce of silver. The dilution is four parts of solution to one of sulphide, and the strength of the solution in NaOH is about 8%. The pulp in this tank is kept mixed by the usual mechanical stirring device. Over the tank is mounted a small tube mill, which makes 10 r.p.m. The charge of aluminum ingots weighs 300 lb. and fills the tube mill half full. Below the tank is a centrifugal pump which circulates the pulp from the tank through the tube mill for ten or twelve hours. When desulphurization is about complete, the precipitate rubbed on a piece of paper by a spatula gives a silvery color and a metallic luster. It is then pumped to another press, where it is washed for two hours; the resulting product, then mixed with a small amount of water, is charged without drying, to the reverberatory refining furnace, and melted down to bullion, which comes out about 996 fine. The slag is saved and put through a small blast furnace.

The grade of the precipitate depends largely on how well the pregnant solution has been clarified before precipitation, but under ordinary conditions it assays about 23,500 oz. before and 26,500 oz. after desulphurization. The final product carries from ½% to 1% sulphur. Gold is not precipitated in an alkaline cyanide solution, and copper does not come down if there is sufficient free cyanide in the solution.

*Excerpts from an article by R. B. Watson, in the "Bulletin" of the Canadian Institute of Mining Engineers, November, 1916.

Considering the present war price of aluminum dust, the continued use of this reagent for precipitation is out of the question. It would appear, however, that even when prices of all chemicals used return to normal, sodium-sulphide precipitation will be cheaper than the method formerly employed.

ANALYSIS OF PRECIPITATE

| | Before Desulphurizing, % | After Desulphurizing, % |
|---|---|---|
| Ag | 81.21 | 91.72 |
| S | 12.09 | 0.58 |
| Soluble in water | 2.02 | 0.52 |
| Insoluble in acid | 2.63 | 3.03 |
| FeO | 0.46 | 0.57 |
| CaO | 0.44 | 0.49 |
| $Al_2O_3$ | 1.32 | 1.55 |
| MgO | 0.14 | 0.16 |
| Hg | 0.10 | 0.11 |
| | 100.41 | 98.73 |

The precipitate contained no Au, Pb, Cu, Bi, Co, Ni, Sb, As or Zn.

In the following comparison pre-war prices are given; the quantity of aluminum dust used per ounce silver is the average for 1915.

COST OF SULPHIDE COMPARED WITH ALUMINUM PRECIPITATION

| | Cents per Oz. Silver |
|---|---|
| **Aluminum-Dust Method** | |
| 0.0262 lb. aluminum dust @ 33.82c | 0.8861 |
| 0.05 lb. caustic soda @ 2.11c | 0.1055 |
| Labor, power, and workshops | 0.1710 |
| | 1.1626 |
| **Sodium-Sulphide Method** | |
| 0.12 lb. commercial sodium sulphide @ 1.89c | 0.2268 |
| 0.006 lb. aluminum ingots @ 19.25c | 0.1155 |
| 0.03 lb. caustic soda @ 2.11c | 0.0633 |
| Labor, power and workshops | 0.3020 |
| | 0.7076 |
| Difference in favor of $Na_2S$ method | 0.4550 |
| Saving per year—2,000,000 oz. @ 0.455c | $9,100 |

It has been shown in Hamilton's article that a large part of the saving in the use of aluminum over zinc dust is in the regeneration of cyanide. By comparing the first equation with Hamilton's equation, given here, it will be seen that the regeneration is the same when sodium sulphide is used.

$$2NaAgCy_2 + 4NaOH + 2Al = 4NaCy + 2Ag + Na_2Al_2O_4 + 4H.$$

The process as described is limited in its application to silver ores, as gold sulphide is not precipitated. It is possible, however, that the procedure given could be used to precipitate the silver, followed by the precipitation of the gold in the solution by aluminum.

## Liability for Demurrage Charges

By A. L. H. Street*

A mining company asks citation to judicial rulings relative to the payment of demurrage on cars which, although shipped at intervals, have been bunched by the railroads en route and, arriving together, prevent the consignee from unloading them all before demurrage accrues.

According to a Federal court ruling, it is a valid defense to a carrier's claim for demurrage charges that the carrier delivered cars to the consignee in such large numbers and so unreasonably concentrated them as to prevent the latter from handling them promptly, choking and overwhelming the delivery tracks, with knowledge of the impossibility of prompt unloading. Louisville & Nashville Railroad Co. vs. Empire State Chemical Co., 189 Federal Reporter, 174.)

And it was declared by the Interstate Commerce Commission in a conference ruling that tariffs ought to contain a rule providing that when, by fault of the carrier, cars are bunched in excess of the shipper's or consignee's ability to handle them within the free time, demurrage will not accrue, but that in the absence of such a rule the commission can determine the reasonableness of such practice only upon complaint filed.

The commission has decided the following additional points, as shown by opinions reported in the cited pages of that body's reports:

A tariff rule may validly provide that demurrage shall not accrue so far as the delay is caused by the carrier bunching cars and delivering them in excess of the consignee's unloading facilities (15 I. C. C. 160, 164). Unreasonable delays in transportation should not cause demurrage to accrue (18 I. C. C. 38, 46). But where the cars are held off private delivery tracks because of the consignee having more business than facilities to handle it, there cannot be said to be such "bunching in transit" as avoids demurrage charges (22 I. C. C. 358). If the consignee has reasonably adequate unloading facilities, demurrage charges may be found to have been unreasonably imposed, where he complained against the setting in of too many cars at one time (15 I. C. C. 160).

But to justify an exemption from established demurrage charges, there must be some showing of active fault on the part of the carriers, producing the congestion; mere proof as to delivery of cars in excess of daily shipments is insufficient to entitle a consignee to exemption. The courts exact clear proof of fault of the carrier in such cases, since the exemption might otherwise be made the means of giving unjust favors to particular shippers (24 I. C. C. 27, 32; 21 I. C. C. 197, 198).

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## Higher Tax on Mexican Oil

Decided increases in the export duties on crude oil and its products are provided for in a decree outlined by the Mexican Department of Fomento and now awaiting the signature of General Carranza, according to the New York *Sun*, Feb. 26, 1917.

According to the decree the tax will be graduated according to the specific gravity of the oil. Oil of a higher gravity than 0.94 will be taxed 80 centavos per ton, and lighter oil will pay 10 centavos per ton additional for each degree less than 0.94. A tax of 5% on the commercial value will be placed on refined products, which now pay no export tax.

The present tax of 60 centavos per ton on crude oil for Mexican consumption is abrogated. A tax of 120 centavos is placed on all oil wasted at new wells or not utilized from flowing wells. The proposed decree is intended to become effective July 1. The present export tax is 60 centavos a ton without regard to gravity.

It is believed the tax will increase the government's revenues largely, but oil men say it will make it difficult for Mexican producers to compete with foreign companies on kerosene, gasoline and other derivatives.

**The One-Man Drill and the Carr Bit** have doubled the output of the Lake Superior miner of a few years ago, according to "Mineral Resources of Michigan," published by the state. A close study of the breaking of ore underground and the introduction of lighter and more efficient drilling machines have resulted during the last five years in a saving of over $2,000,000 to the mining companies and at the same time the workingmen have benefited by over $1,000,000.

# Edward Dyer Peters

Prof. Edward Dyer Peters, a member of the faculties of Harvard University and the Massachusetts Institute of Technology and a well-known metallurgical expert, died in Dorchester, Mass., Feb. 17, at the age of 67. Professor Peters was a native of Dorchester, and that place, which became a part of the City of Boston, was his home throughout his life. He was born in Dorchester, June 1, 1849.

Dr. Peters, as he was called commonly, earned his high rank in the large army of mining and metallurgical engineers, not only by his services in the field of practice, but also by his eminent contributions to the literature of his profession. One reason for his success, apart from his inherent talents, was the breadth of his education, which covered not only the sciences and arts of the profession by which he became best known, but also those of medicine and surgery. After completing his preliminary studies in this country, fitting to enter college, he made up his mind that a scientific education would be more suited to him and went to Germany, where he entered the *Bergakademie* at Freiberg, Saxony. He studied for four years at Freiberg, paying special attention to metallurgy and, besides the regular course, spent all his summers in practical work in the mines, concentrating mills and smelting works. On completing his course at the *Bergakademie* in 1869, he successfully passed the examinations in metallurgy, assaying, chemistry and mineralogy, obtaining in every case the highest or next to the highest mark. During the latter part of his residence at Freiberg he served as president of the American colony there, which was at that time a flourishing organization numbering about 42 members.

EDWARD DYER PETERS

Returning to the United States in 1869, Dr. Peters went at once to Colorado, where he immediately found employment in the practice of his profession. He remained in Colorado for five years, occupying various positions, among others that of assistant superintendent of the Caribou mill and Territorial Assayer, being appointed to the latter office in 1870. During the same year he built the Mt. Lincoln smelting works, and remained the superintendent of that plant for about three years, or until the Moose mine, which supplied it, was practically worked out. All his work in Colorado was marked by that close observation of details and application of true principles to reasonable practice which characterized his subsequent career.

Dr. Peters was called East by family affairs in 1875, and while continuing to act as a consulting mining engineer, spent the next three years in the study of medicine at the Harvard Medical School, graduating first in a class of 160 and being the only one whose thesis was mentioned on the commencement program. He actually practiced medicine for a short season, but finding that the ties which connected him with the profession of metallurgy were becoming stronger and stronger, he finally gave up all idea of following his other profession and then became busily engaged in building and managing smelting works. Between 1880 and 1890, Dr. Peters originated or was associated with several of the largest copper-smelting establishments in the United States. He was for some time metallurgical manager for the Orford Nickel and Smelting Co., which was the name of the company then operating the celebrated plant at Constable Hook. He erected the first successful concentrating and smelting works of the Parrott Silver and Copper Co., at Butte, Mont. He planned the refining plant of the Calumet & Hecla company and designed and started the very efficient works of the Canadian Copper Co. at Sudbury, Ont., for the production of nickel-copper matte. Dr. Peters' ability as a designer and safe guide became so well established that several works in Europe owed their construction to him, and he was almost always, as a matter of course, consulted by the promoters of new copper-smelting enterprises on this side of the Atlantic. Even as early as 1890, however, his fame had become world-wide, and in the early 90's he filled a highly important engagement in Australia.

During the 90's Dr. Peters was occupied with numerous engagements as consulting metallurgical engineer, but having already acquired financial independence through the practice of his profession, he retired gradually from active work in the field and devoted himself more and more to study and technical literature. About 1900 he became lecturer on metallurgy in Harvard University, and finding that work congenial, he was offered and accepted the chair of metallurgy in the university in 1904. He continued to fill that chair up to the time of his death, appearing also on the list of the faculty

of the Massachusetts Institute of Technology after the alliance of that institution with Harvard a few years ago.

Dr. Peters' reputation rests not only on the success of the establishments he has engineered, but especially on the unique character of his first and most famous book. He began to write on technical subjects at an early date. Thus, in 1873 his name is found in the *Transactions* of the American Institute of Mining Engineers on a paper dealing with the Mount Lincoln smelting works, his first professional undertaking. About 1882-83 he made contributions on the metallurgy of copper to "Mineral Resources of the United States." A little later he contributed a series of papers to the *Engineering and Mining Journal,* which in 1887 were published in book form under the title of "American Methods of Copper Smelting." The first reference to this book is to be found in the *Journal* of Oct. 29, 1887, as follows:

> Congratulatory letters upon the excellence and value of Dr. E. D. Peters' work, "American Methods of Copper Smelting," continue to reach us by each mail. All our correspondents admit that it is superior to anything else on this subject in our language, and those of our subscribers who have failed to keep a file of the "Journal" in which it originally appeared in serial form, are strongly recommended to secure the volume. It has been completely revised, improved, and brought up to date by the author.

As a rule the literature of science and art originates from the student, not from the practical worker. Hence, in technical books there is usually a preponderance of experimental and theoretical matter and a deplorable absence of the detail of construction and manipulation, of which the workingman, when he proceeds to build and to manufacture, stands so sorely in need. Dr. Peters' treatise, on the other hand, was immediately recognized as a working manual for the working copper smelter by a fellow workman. It gives the most minute directions to the furnace builder, specifies accurately the quantities and qualities of the material to be used in construction and instructs the metallurgist so precisely how to handle the apparatus he has completed that the opprobium of ambiguity, which is so justly and generally cast at authors of technical treatises, could never be cast upon this notable book. However, it merely reflected the character of its author.

"American Methods of Copper Smelting" immediately became a recognized authority on the subject. The first edition was exhausted in a few years, and the second edition, revised, corrected and greatly expanded, was issued in 1891 under the title of "Modern American Methods of Copper Smelting." Since then there have been many editions. Published by the book department of the *Engineering and Mining Journal* and later by its successor, the McGraw-Hill Book Co., we are able to say that in the history of this business, covering a period of more than 30 years Dr. Peters' first book has been the "best seller." Up to date the total sale has been over 20,000 copies. The seventh edition, published in 1895, was revised again, and the title was changed to "Modern Copper Smelting."

Dr. Peters' second great treatise, the "Principles of Copper Smelting," published in 1907, was esteemed by himself more highly than his first one. Without any doubt it was a far more erudite and more scholarly production. This was devoted to the *reasons why* instead of to the *means how*. It was well received, but it did not meet with the same degree of popular appreciation that fell to his first book. Perhaps it has not had the recognition that it deserves, for surely it is one of the classics of metallurgical literature. In 1911 was published the "Practice of Copper Smelting." This was a rewriting of "Modern Copper Smelting," but the demand for the latter kept up to such an extent that the publishers continued to supply it.

We have dwelt at length upon the subject of Dr. Peters' writings, for it is by them that he is best known and by them that his fame was established. Although an experienced metallurgist in practice and one of a wide variety of experience, his career in the field was not signalized by participation in great improvements in the art. It was, however, characterized by keen perception, clear thinking and good judgment. When, therefore, a man of such experience and such qualities set out to write a treatise on his special subject, he was bound to do it in a distinct way; and that way opened a new era in metallurgical literature. All subsequent writers have tried to offer in their own subjects the same kind of a book that Peters did in his, if there were any opportunity for them to do so, and to Peters we may therefore trace much of the influence and inspiration that have given us the great, invaluable metallurgical literature of the last 25 years.

His colleague, Professor Hofman, of Harvard and the Massachusetts Institute of Technology, has contributed the following appreciation of Dr. Peters as a teacher: "While the engineering career of Professor Peters has been brilliant, his teaching has been not less successful. He had the gift of bringing in an agreeable manner before his students clearly and convincingly what he had to say; the students liked him and he liked the students. Kindliness and unselfishness are characteristics which a student-body appreciates readily. Since the affiliation of the Harvard Graduate School of Applied Science with the Institute, the inborn wish to help made itself manifest in the new surroundings, so that his new colleagues quickly learned to appreciate the lovable character of the man. With the death of Professor Peters, the metallurgical world has lost one of its American pioneers, the teaching profession a conscientious and enthusiastic man, and the personal associate a true friend."

## Potash Producers

Producers of potash (stone-ash or crude potash, black salts or black flux, and pearlash or white flux) obtained by the old-time method of leaching wood ashes are writing to the United States Geological Survey, Department of the Interior, complaining of a lack of market for their product. This seems an anomalous situation in view of the scarcity of potash in the United States and the need for potassium carbonate for glass and the caustic for soap making, and in laundry use especially.

Thirty-three producers have reported to the Geological Survey over 600 tons of these materials, valued from 7 to 70c. a pound according to degree of refinement. This class of materials includes caustic potash, and mixtures of caustic potash, potassium carbonate and potassium sulphate with organic and some kinds of inorganic matter.

The Geological Survey will be pleased to act as intermediary in bringing producers and buyers of these materials together. A list of such potash and pearlash producers, particularly mentioning those who report a stock of material on hand, will be sent on inquiry.

## Great Britain Prohibits Dealings in Lead

Dealings in lead were prohibited on Feb. 2 by the British government except under license and for the execution of contracts. The order of the Minister of Munitions establishing this embargo was in the following terms:

1. No person shall as from the date hereof until further notice purchase, sell or, except for the purpose of carrying out a contract in writing existing prior to such date for the sale or purchase of lead, enter into any transaction or negotiation in relation to the sale or purchase of lead situated outside the United Kingdom except under and in accordance with the terms of a license issued under the authority of the Minister of Munitions.

2. No person shall as from the date hereof until further notice purchase or take delivery of any lead situated in the United Kingdom except under and in accordance with the terms of a license issued under the authority of the Minister of Munitions, or sell, supply or deliver any such lead to any person other than the holder of such a license and in accordance with the terms thereof; provided that no such license shall be required in the case of any sale, purchase or delivery of such lead—

a. For the purpose of a contract or order for the time being in existence certified to be within Classes "A" or "B" of Circular L.33 as to Control of Output issued by the Minister of Munitions on Mar. 31, 1916, where the price paid upon such sale or purchase does not in the case of virgin pig lead exceed £29 per ton net and in the case of remelted lead, or old or scrap lead, exceed £26 per ton net.

b. For the purpose of necessary repairs or renewals involving the use of not exceeding 1 cwt. of such lead.

3. No person shall as from the date hereof until further notice use any lead for the purpose of any manufacture or work except:

a. For the purpose of a contract or order for the time being in existence certified to be within Classes "A" or "B" of Circular L.33 as to Control of Output issued by the Minister of Munitions on Mar. 31, 1916.

b. For the purpose of necessary repairs or renewals involving the use of not exceeding 1 cwt. of lead.

c. For the purpose of type casting from lead already in the form of type or purchased for that purpose at the date hereof.

d. Under and in accordance with the terms of a license issued under the authority of the Minister of Munitions.

4. All persons shall within ten days from Feb. 1, 1917, and within seven days from the first day of each succeeding month send in to the Director of Materials (A.M.2.[E]), Hotel Victoria, Northumberland Ave., London, S.W., monthly returns of—

a. All lead held by them in stock or otherwise under their control on the last day of the preceding month.

b. All lead purchased or sold by them for future delivery and not yet delivered on such last day, together with the names of the sellers to or purchasers from them.

c. All lead delivered to them during the preceding month.

d. All contracts or orders existing on the last day of or entered into during the preceding month requiring for their execution the use of lead for any purpose, specifying the amounts of lead required weekly for the purposes of such contracts or orders and distinguishing between the amounts required for Classes "A" and "B" respectively of Circular L.33, and the amounts required for other purposes.

Notwithstanding the above, no return is required from any person whose total stock of lead in hand and on order for future delivery to him has not at any time during the preceding month exceeded 1 cwt.

5. For the purpose of this Order the expression lead shall mean pig lead, whether virgin or remelted, sheet lead, lead pipe, and old and scrap lead or any of them.

6. All applications for licenses to purchase or use lead shall be made to the Director of Materials (A.M.2.[E]), Hotel Victoria, Northumberland Ave., S.W., and marked "Lead License."

Note—Licenses to purchase and take delivery of lead situated in the United Kingdom will usually be granted by the Minister of Munitions under the above Order for necessary repairs and renewals in the ordinary course of trade and will also be granted for any other purposes which may be approved by the Minister of Munitions, including manufacture for the purposes of export trade. Every applicant for a license must state the amount of metal required by him per month and the use to which it will be put. Any person acting in contravention of or failing to comply with the above Order will be guilty of an offense under the Defence of the Realm Regulations and be liable to penalties of fine and imprisonment.

## Silver Production of the World

In the following table is given the world's production of silver as collected by the Director of the Mint and published in his annual report for the fiscal year ended June 30, 1916, which includes also a report on the production of precious metals in the calendar year 1915.

THE WORLD'S PRODUCTION OF SILVER IN 1914 AND 1915

| Country | 1914 Oz. Fine | 1915 Oz. Fine |
|---|---|---|
| North America | | |
| United States | 72,455,100 | 74,961,075 |
| Canada | 28,406,711 | 28,401,503 |
| Mexico | 27,546,752 | 39,570,151 |
| Central America | 2,754,868 | 2,920,496 |
| South America | 10,448,557 | 13,687,464 |
| Europe | 9,240,025 | 9,276,920 |
| Australasia | | |
| Australia | 2,973,915 | 3,338,214 |
| New Zealand | 599,162 | 957,541 |
| Asia | | |
| British India | 236,440 | 284,875 |
| China | ..... | 18,230 |
| Chosen | 16,864 | 21,876 |
| East Indies, Indo-China, etc | 52,847 | 48,032 |
| Japan | 4,836,228 | 5,079,552 |
| Africa | | |
| Belgian Congo | 4,770 | 4,770 |
| Rhodesia | 150,794 | 185,233 |
| Transvaal, Cape Colony and Natal | 901,763 | 996,379 |
| All other Africa | 1,223 | ..... |
| Total for World | 160,626,019 | 179,753,978 |

## January Oil Production in California

January oil production in California totaled 8,082,090 bbl., a gain of 145,119 bbl. over December. Shipments in January amounted to 9,487,882, decreasing the stocks by 1,405,792 bbl. The stocks on hand at Feb. 1, were 42,234,502 bbl. These are the figures of the Independent Agency. The Standard Oil figures show a decline of field stocks of only 976,000 bbl. and some other figures differ from the Agency report. At the end of the month 312 wells were drilling, an increase of 26 over December.

# Correspondence and Discussion

## The Baghouse of the St. Joseph Lead Co.

The thorough description of construction, operation and yield of the baghouse collecting lead fume, by S. Paul Lindau, in the *Journal* of Feb. 17, 1917, is interesting to me, since I, in association with F. L. Bartlett, in Portland, Me., in the 80's, and unassociated in the 90's, built and operated what were perhaps the first baghouses collecting zinc-lead fume and contending with $SO_2$ and $SO_3$ gases.

Several types of bag structures were built, and much the same conclusion was reached then as now, relative to details of construction and operation. While the type of bag shaker designed by Mr. Saunders, said to be efficient, is not made clear, I designed the lifter-cam type now used in the mechanical bag machine marketed and installed by the engineering firm of Simon, Buhler & Baumann, which I believe is the most efficient of any so far invented, and I greatly marvel at the amount of hand bag-shaking still going on in America with the detriment to human health, when 20 years ago an ideal apparatus existed. It merely illustrates the perverseness of engineers or the unwillingness of industry to adopt advances.

I note in this article that cadmium concentrates itself up to the averaging figure of 15 to 20% in the fume and that a remedy or removal of this cadmium is sought. I never removed cadmium in the concentrated proportion here discussed, but in Portland continually clarified the fume from cadmium, selenium, indium and lighter volatile bodies by passing it at a red heat through revolving muffle tubes.

I brought this practice to considerable perfection in apparatus and detail and see no reason why at periods the cadmium, as concentrated at Herculaneum, should not thus be simply removed, as I performed it 20 to 30 years ago. It may be desirable to mix in 3% or so of coal dust when practicing muffle volatilizing. The cadmium will be produced as a fume mixed with many other rare metals in accordance with the orebodies treated, etc.

Of late years another method of removing cadmium has presented itself to my mind, which yields the metal form with very little zinc and practically no lead. This process is probably capable of purifying spelter without distilling the zinc, but being of novel design, had best not be publicly described.

It is interesting to see the pioneer work of 25 to 30 years ago becoming the basis of extensive operations, and as an independent engineer I am interested in following or assisting in all such work and am a firm believer in the dissemination of practical ideas.

There is far too much research work hidden by selfish interests or neglect, which costs in rediscovery many times what it should and generally delays community advance and technical efficiency. We should be reaching a stage of economic efficiency or civilization when common commodity practice should be on call at the minimum cost. Much of the work I did 20 to 30 years ago is now repeated on a larger scale under slightly modified conditions, and I am quite ready to aid the St. Joseph Lead Co. or any other industry, meeting problems of the volatile nature, with the added advices that modern relations suggest.

Mr. Lindau's article speaks of an installation of Scotch hearths being made, and I would call attention to the discussion in the *Journal*, Nov. 25 and Dec. 9, 1916, between Messrs. Garlichs, Dwight and myself.

Essex, Mass., Feb. 20, 1917. PARKER C. CHOATE.

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In my article on "The Baghouse of the St. Joseph Lead Co.," published in the *Journal* of Feb. 17, on page 294, the last sentence in the third paragraph should read as follows: "The amount of lead in dust and fume entering the baghouse is fairly constant while furnaces are running at normal conditions, so a determination of the gas entering the baghouse is 'not' always necessary when the escaping gases are being sampled."

Also, just below in formula (2) the word "commercial" should read "numerical." S. PAUL LINDAU.

Herculaneum, Mo., Feb. 20, 1917.

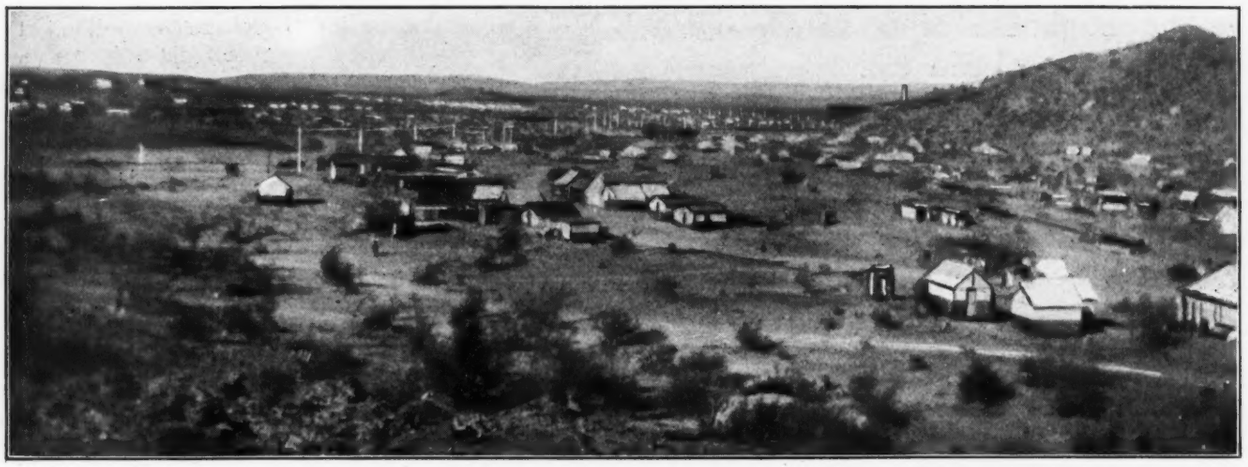
## Government Aid for Mining in British Columbia

In the *Journal* of Jan. 20 the Washington correspondent quotes Premier Brewster as saying: "I have always wondered why, when we have large deposits of iron ore on Texada Island, with a short and cheap water-haul to the coal measures on Vancouver Island and all the other requisites, we have yet no steel industry." I venture to suggest the answer to this is very simple, and if the Honorable Premier had studied the iron and steel problem or had followed the columns of the *Journal*, he would have discovered that one of the prime "requisites" for a steel industry is a market.

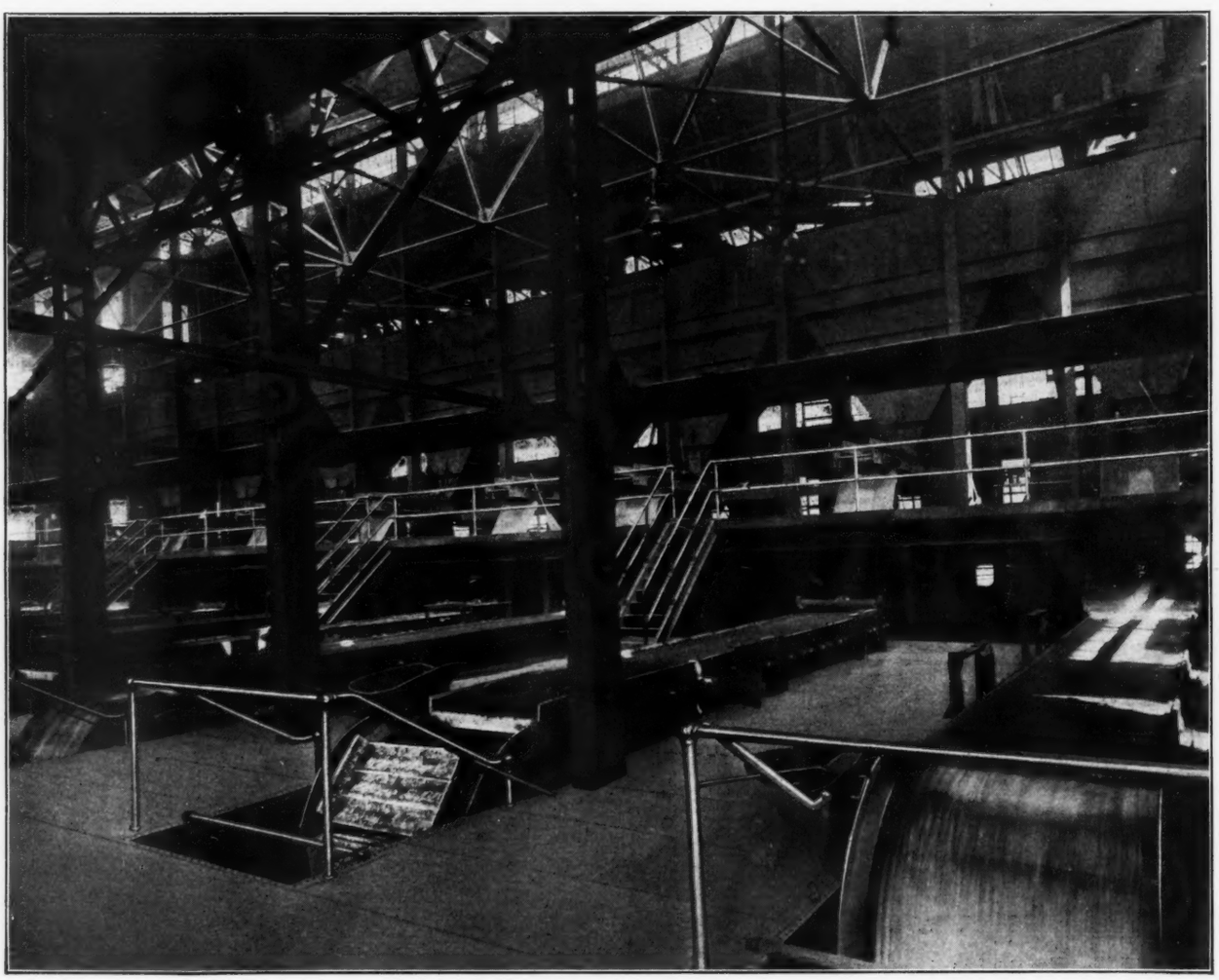
Texada and Vancouver Islands may furnish all the coal, iron and other raw materials required, but it is susceptible of proof by figures, as has been demonstrated in the columns of the *Journal*, that proximity of the consumer's market is a *sine qua non* of a successful steel industry. Freight rate on finished product to the consuming center is a more important factor than freight rate on coal and iron to the furnace. When Pittsburgh became the center of the steel producing industry of the country it was also the center of population and only when the center of population moved west were steel plants of importance established at Chicago and Duluth. When the Pacific Coast demand for steel becomes great enough, or when the rail rates become low enough to deliver the product in the East against competition, then and then only may the hopeful Premier expect to see a successful steel industry on Texada and Vancouver Islands.

New York, Jan. 20. M. R. PERCY.

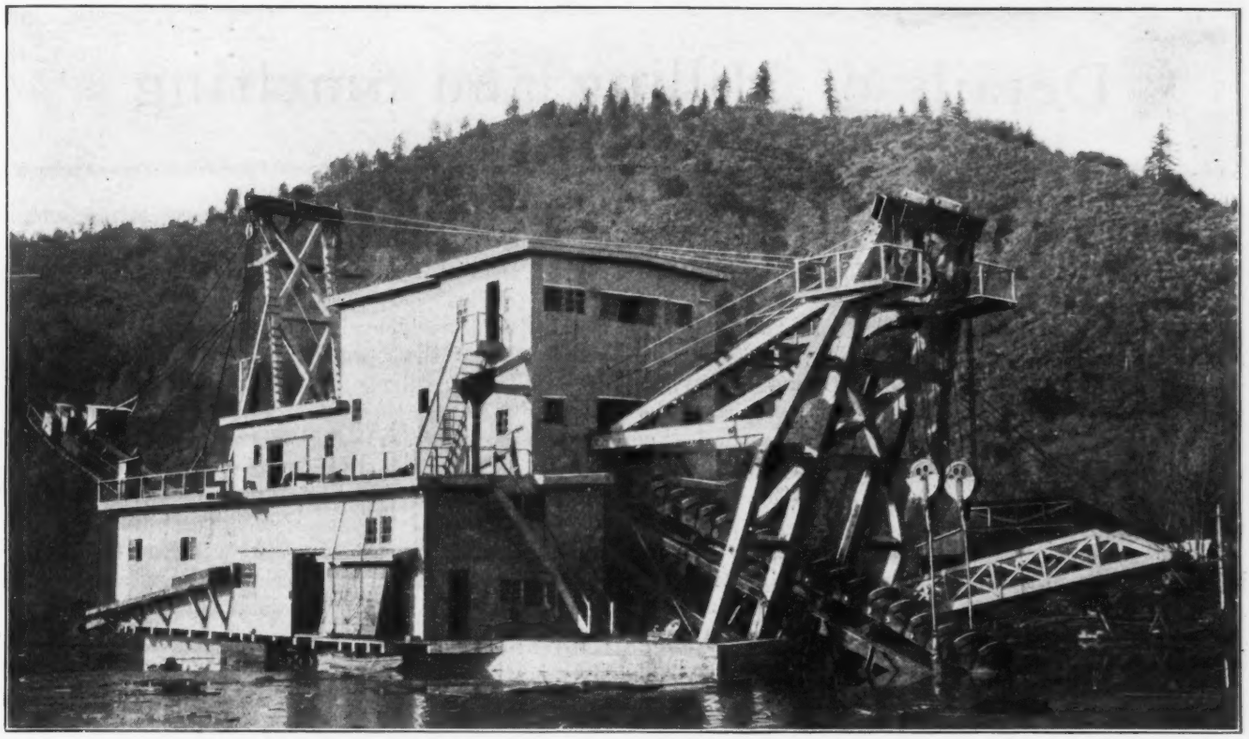
# Photographs from the Field



LOOKING NORTH ACROSS PART OF AJO, ARIZ.; NOW REACHED BY RAILOAD AND TELEGRAPH
In the distance are the new towns of Gibson, Clarkson and Cornelia. Near the last-named town, at the right, is the copper-leaching plant of the New Cornelia Copper Co.



DWIGHT & LLOYD SINTERING MACHINES AT ST. JOSEPH LEAD SMELTERY, HERCULANEUM, MO.



VALDOR GOLD DREDGE ON TRINITY RIVER, NEAR JUNCTION CITY, CALIF.
This Union Iron Works dredge, with 7-cu.ft. buckets, started operating Nov. 18, 1916

SPHALERITE CAVERN IN MONTREAL MINE NEAR CENTURY, OKLA.
In this rich mine in the Oklahoma section of the Joplin district a number of caves have lately been encountered; no blasting had been done in this opening at the time the photograph was taken

# Details of Milling and Smelting

## Flotation on the Rand

A paper describing some flotation experiments on a Transvaal gold ore was published by F. Wartenweiler in the *Journal* of the Chemical, Metallurgical and Mining Society of South Africa, for November, 1916. The investigation had for its object the maximum recovery of gold from an arsenopyritic gold ore developed below the oxidized ground of the mine workings of a Barberton mine. Cyaniding this sulphide ore after grinding to 150-mesh gives a maximum extraction of 45%. This low extraction is increased from 3 to 5% by preliminary treatment with solution of sodium carbonate or sodium hydrate for the dissolution of arsenical sulphide. The recovery by amalgamation was negligible. Roasting, followed by cyaniding, gave an extraction of 82.5 in total, but such treatment was prohibitive on account of high operating cost. Trials with gravity concentration and cyaniding of the concentrate tailings were made, giving a total extraction of 70%, figuring the gold in concentrates as recovered.

Flotation tests with various oils and in neutral, alkali, and acid solutions were carried out at the Rand Mines metallurgical laboratory with a mechanical-agitation type machine. Tests were repeated until a sufficient amount of concentrates and tailings were obtained for further extraction tests. A small portion of coarse sulphide not floated was recovered by panning and added to the flotation concentrates. Unless the ore was ground extremely fine, flotation needed this supplementing by gravity concentration. The best results, from a commercial and metallurgical point of view were obtained in a slightly alkaline circuit. The ore, which had been kept submerged to prevent serious oxidation, was ground in water through 90-mesh. It was pulped in water in a ratio of 5 to 1, with wood creosote and paraffin oil. Sufficient lime in solution was added to bring the alkalinity to 0.005% CaO. After agitation in the machine for 15 minutes, withdrawing the froth concentrates with a skimming tool, as it was formed, the dark persistent froth of fine mineral floccules gradually changed to a froth of a lighter color, and gangue composed of slaty and schistose material was floated. The machine was stopped when this stage was reached, and the tailings discharged. The froth formed during the early operation of the test carried clean mineral showing selective action by the oils used and a flocculation of the fines. Flotation and skimming of the froth was continued until the froth forming showed no sulphide. This prolonged flotation contaminated the concentrates, and they were therefore subsequently cleaned by running through the machine again. The products from this last operation were concentrates and middlings. This procedure is considered sound and is established by modern practice, the middlings easily being returned to the head of the roughing machine for reconcentration. Counting the concentrates and middlings as total recovery, the percentage extraction by the flotation tests amounted to 79%.

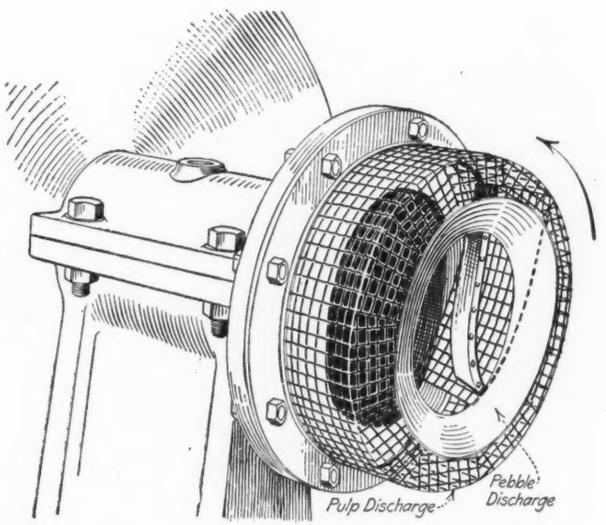
The concentrates were cyanided after roasting, and it was found that there was no premature precipitation of gold by residual carbon from flotation oil ignited during roasting. This point was determined by post treatment of the cyanide residue with sodium sulphide. The striking feature of the extraction test was the comparative ease of dissolving the gold in the middlings and tailings, a feature which emphasizes the extent of the transference of refactory minerals to the concentrates by flotation.

In a commercial application it is advisable to assume a 5% loss of the gold contained in these particular arsenical concentrates by volatilization during roasting. The total recovery, including concentration, cyaniding the concentrates and cyaniding the flotation tailings, amounts to, after accounting the loss by volatization, 84.05%.

## Tube-Mill Discharge Screen

By A. W. Allen*

The screen illustrated herewith was designed to meet the requirements where lack of fall existed at the discharge end of the mill. It proved superior to the usual arrangement. The discarded pebbles and gravel are lifted at each revolution of the mill by an additional piece of




TUBE-MILL DISCHARGE SCREEN

screen which runs from the screen periphery to the point of discharge; and a strip of light iron plate, curved to fit, is bolted to this and placed so that it tends to carry the coarse material toward the opening, where it is delivered to the lip and is then discharged. The apparatus works satisfactorily and needs no attention. By the use of a water spray on the screen, the pebbles can be discharged clean and free from adhering slime.

*Metallurgical engineer, 309 Broadway, New York.

# Details of Practical Mining

## Aids in Estimating Concrete Costs

The Cement Tile Machinery Co., of Waterloo, Iowa, has issued for users of concrete, a pamphlet entitled "The Concrete Dope Book," in which much information of interest to those engaged in mining or metallurgical construction can be found. The following data in regard to concrete estimations should prove useful—keeping in mind that a factor of 10 to 20% should usually be added for mining or metallurgical work to allow for greater difficulties of mine construction. The data in the pamphlet are based on practice in cities where conditions are better than those found during the construction period at mines or metallurgical works.

For plain work, such as dams, retaining walls, etc., the cost of framing and erecting forms is estimated at between $7 and $8 per M. ft., b.m., while the cost of tearing down is estimated at $2 per M. The cost of erecting and removing forms for general work is considered to be about 1c. per sq.ft. of wall surface to be formed. In reinforced-concrete building work it is estimated that forms erected will cost about 8c. per sq.ft. of form surface. Another rule for estimating ordinary wall work where rough lumber is used, is to allow 50 to 75c. per cu.yd. of concrete. This price includes the cost of lumber and labor for framing both sides of the wall.

A rule for estimating labor costs on concrete is to allow one man one day for each ¾ yd. of concrete used, or it is estimated that two men will average 1 cu.yd. of concrete, including the building of the forms. For ordinary reinforced-concrete walls the labor can generally be estimated by allowing one man one day for 1½ cu.yd. of concrete. For concrete columns and pilasters the labor can be estimated by allowing one man one day for each cubic yard of concrete used. A four-man crew mixing by hand will average about 9 cu.yd. per day, provided the material is not wheeled more than 50 ft. Mixing by hand costs approximately 5c. per cu.yd. for each turn given the mixture. One man will mix, place and finish on an average 100 sq.ft. of 4-in. concrete floor in 10 hr. Material can be shoveled at a cost of about 10c. per cu.yd. Wheeling material an average of 50 ft. costs approximately 6c. per cu.yd. Cement can be unloaded from car directly to storage bins at a cost of approximately 2c. a barrel, and if unloaded by wheelbarrows and wheeled a distance of 100 ft., the cost will probably be about 3c. per barrel. The cost of loading concrete into wheelbarrows is approximately 4c. per cu.yd. It is generally estimated that a man will mix by hand about 2½ cu.yd. of concrete per day. The cost of handling concrete by spouting is usually about 70c. per cu.yd. A man will tamp thoroughly about 25 cu.yd. of material into a layer 6 in. thick in 10 hr. For ordinary work, such as retaining walls, arches, culverts, etc., the cost of placing steel is from ¼ to ½c. per lb. In reinforced-concrete building the cost of placing steel is ¾ to 1c. per lb. The cost of finishing walls where forms have been used is about 1c. per sq.ft.

The cost of loading sand and gravel into cars is approximately 20c. per cu.yd. The cost of shoveling sand direct from car to storage bin is generally from 6 to 10c. per cu.yd. One man will usually load from 15 to 20 cu.yd. of sand into wagons in 10 hr. The cost of hauling sand by teams is about 26c. per mile. A cubic yard of sand, gravel and crushed stone is a fair load for a team. A man and team using ordinary dump ore wagon will load and haul on an average 5 loads of sand a distance of 1½ mi. from pit to storage is 9 hr. The cost of loading sand, stone or gravel in wheelbarrows is approximately 12c. per cu.yd. Cost of washing sand and gravel is about 20c. per cu.yd. with work done by hand. These factors should prove of assistance in estimating and planning concrete work.

## Ventilation at Old Dominion

Every mine superintendent realizes that his men will accomplish more when working in well-ventilated stopes. As a matter of fact, there is no bigger money loser in mining than poor ventilation and every company knows it. But conditions are often such as to render good ventilation a difficult attainment at the moment. The Old Dominion *Bulletin* for December cites as an instance the west workings of that mine at Globe, Ariz., which stretch under a capping of water-filled dacite formation, through which it is impracticable to sink a shaft farther west than the *C* shaft. All the fresh air, therefore has to travel a long distance west before it can be utilized through the stopes. The lowest levels of the mine are necessarily hot because they are the levels through which the warm used air is brought to be returned to surface through the upcast *A* shaft.

The present equipment for ventilation in the Old Dominion mine consists of a 100,000-cu.ft. fan at the *K* shaft to ventilate the east-side workings with a return system to the *A* shaft on the 16th level east, and a 75,000-cu.ft. fan at the *C* shaft to provide fresh air for the west workings, which air is returned to the *A* shaft on the 18th level west.

In addition there are in the mine the following smaller booster ventilating fans: Five of 80,000-cu.ft. capacity each, and ten others ranging in capacity from 1000 up to 30,000-cu.ft. output.

During the last six months a large number of air-operated ventilation doors have been installed to improve the air currents and also numerous hand-operated doors for the same purpose.

During the first ten months of 1916, the company expended $47,000 to provide adequate ventilation in the mine, entailing a cost of 16c. per ton mined. In addition new ventilating equipment, costing about $20,000 to purchase and install, will be placed in the mine in the first half of 1917, to improve further the system. A new *C* shaft blower fan of practically double the

present capacity, a big suction fan on the 18th level and several large booster fans will form part of the new system to provide more air, and cooler working places; also, specially designed ventilation raises will carry fresh air direct to the lower levels without first having to pass through the stopes above.

## Apparatus for Mixing Soap and Alum Waterproofing with Concrete

In relining the slopes of basins 1 and 2 of the Walnut Hill reservoir at Omaha, Neb., described by Homer V. Knouse, construction engineer, Metropolitan Water District of the City of Omaha, in *Engineering News* of Feb. 1, 1917, waterproofing consisting of bar soap

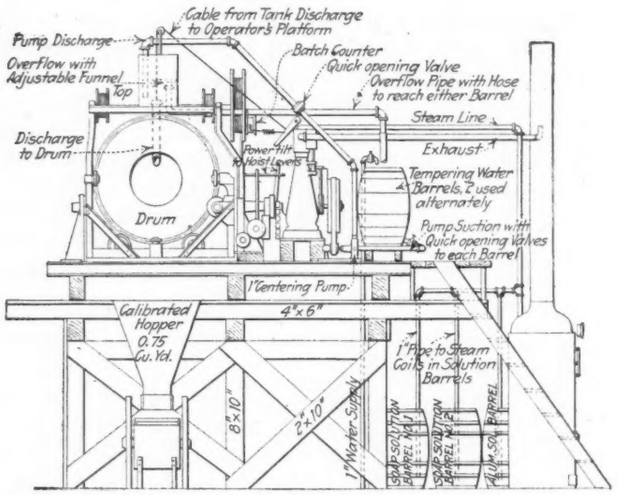



FIG. 1. CONCRETE-MIXING PLANT WITH ATTACHMENT FOR ADDING WATERPROOFING TO MIX

and sulphate of alumina was added to the tempering water before it entered the gaging tank on the top frame of the mixer. To obtain an accurate control of the quantity of these materials applied per cubic yard

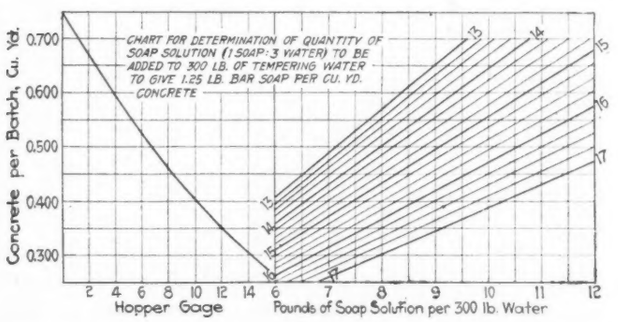


CHART FOR DETERMINATION OF QUANTITY OF SOAP SOLUTION (1 SOAP: 3 WATER) TO BE ADDED TO 300 LB. OF TEMPERING WATER TO GIVE 1.25 LB. BAR SOAP PER CU. YD. CONCRETE
Concrete per Batch, Cu. Yd.
0.700
0.600
0.500
0.400
0.300
2 4 6 8 10 12 14
Hopper Gage
6 7 8 9 10 11 12
Pounds of Soap Solution per 300 lb. Water
13
14
15
16
17

FIG. 2. CHART FOR DETERMINATION OF QUANTITY OF SOAP WATERPROOFING SOLUTION

of concrete, special devices were fitted on the No. 11 Smith mixer performing the work.

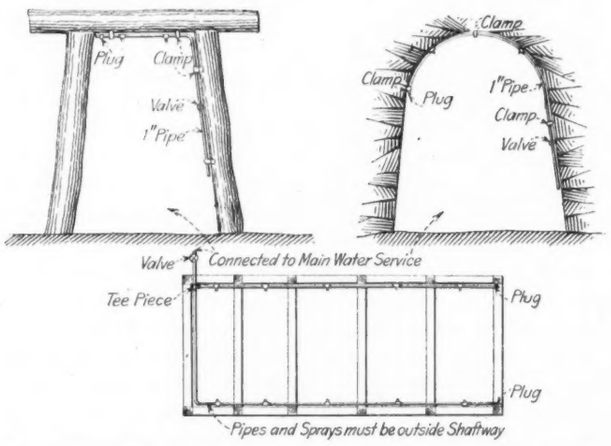
Common bar soap was placed in a 25% solution in barrels on the ground level, the action being hastened by the use of steam coils. A 25% solution of sulphate of alumina, such as serves as a coagulant in water-works practice, was obtained in a third barrel, all so located that the fireman at the boiler could do the necessary work of charging and stirring. Two calibrated barrels on the mixer level were used for preparing the tempering water and were connected to the suction side of a 1-in. centrifugal pump so that each could be used while the other was being prepared. This pump discharged into the gaging tank on the top of the mixer frame, and from it the water was discharged into the drum through a lift valve in the bottom. In order to control the amount of water per batch, an overflow, discharging into the mixing barrels, was applied in the form of a funnel screwed to a long threaded nipple. This gave a large area of weir for quick discharge and allowed adjustment as the moisture content of the aggregates varied.

After mixing, the concrete was discharged into a calibrated hopper; and at frequent intervals the quantity of concrete per batch was measured, although it was found that by the methods followed in charging the skip very little variation occurred. The amount of tempering water per batch was determined by a gage on the upper tank, and from these data the proper amount of soap solution per measured quantity of tempering water was obtained quickly by use of the chart shown in Fig. 2.

Three men were required to operate this equipment—an operator, a fireman and a man to prepare the tempering water. All operating levers and valves were within easy reach of the operator, and the sequence of operations was so arranged that a maximum length of time of the materials in the drum was obtained in each cycle.

## Water Sprays in Drifts

The reduction of dust is of the utmost importance to the health of the workers in South African mines and has been the subject of much attention. Many means or devices furthering the accomplishment of this end are in use. Wet drilling is always practiced. Piping is laid into all the shafts and drifts, and a blast of spray, actuated by compressed air, is turned on immediately after




ARRANGEMENT OF SPRAYS IN DRIFTS AND SHAFTS

blasting. Provisions are made in crusher stations for the thorough wetting down of the ore at all stages in the crushing. Dustless sampling devices have been devised, and there has been put into operation an efficient ventilation system which draws much of the remaining dust out of the workings. The arrangement of the piping and sprays in the shafts and drifts is shown in the accompanying sketches from the report of the Miners' Phthisis Prevention Committee.

# An Ideal Changehouse

By Fred M. Heidelberg*

The construction of what the management considers an ideal changehouse has just been begun at the Dallas shaft of the Copper Queen Consolidated Mining Co., Bisbee, Ariz. A great deal of study was given to this question, and it is believed that every condition that could affect the miner, be it ever so unimportant, was considered.

Sanitation was considered paramount in the design. Absolute cleanliness has to be maintained, and everything is so constructed that it can be readily cleaned. The floors are made of concrete sloping toward a common drain, to permit hosing. The lockers were designed so that they will not be a catch-all for dirt and rubbish. The tops of the lockers slope so that nothing can be placed on them, and they are made small, so that little can be placed in them. Seats are provided below the lockers.

The drying of clothes has been the chief problem in the changehouses of the camp. Without ventilation through the ceiling, clothes would not dry, regardless of the temperature of the room. In order to get the best ventilation, the rafters have been sealed and ventilators have been placed in the ridge of the roof. This method gives an almost perfect circulation of air, and consequently a good drying of wet clothes is accomplished. All clothes have to be hung on the ceiling rafters to get the greatest advantage of the circulating air currents. This gets the clothes out of the way and allows more space to be utilized for other purposes. The dirty and clean clothes of each man are to be separated from each other and from those of his neighbor by means of galvanized iron sheets. The shower room is equipped with showers only, because in other changehouses men washed their bodies in the wash basins, and the man following washed his face in the same basin, ignorant of its previous use. This is considered unsanitary, and therefore basins have been prohibited, thus virtually forcing every man to take a complete shower bath. Both hot and cold water are provided.

Heating the changehouse is accomplished by means of 1½-in. steam pipes on the outer walls. Besides serving to heat the room, this system assists the circulation of the air currents, which augments the drying of clothes. As much light as possible is provided, consistent with good design. Windows were placed wherever and as high as possible, so that the entire room might benefit. The lower sashes of all windows can be raised and thus provide fresh air when necessary. The mine timekeeping offices are housed in one end of the building. They are not usually considered part of a changehouse, although frequently placed there in order to save the expense of a separate building. The details of design of the changehouse are given in the accompanying Fig. 1, showing the floor plan, and Fig. 2, the cross-section. The building will accommodate about 400 men and 24 bosses. It covers a ground space of 130 ft. 5 in. by 30 ft., with two 20x20-ft. shower rooms on the back. The height of wall to rafters is 15 ft. 6 in. The foundation is of concrete and is allowed to project up as a 9-in. wall 1 ft. 6 in. above the ground, in order to keep the floor drains within the building. A 4x4-in. timber is bolted to this 9-in. wall as a bottom plate, and on it the 2x6-in. studding is nailed. A double studding is provided at all corners and on both sides of all openings. The outside of the studding is covered with No. 24 corrugated galvanized iron, while the inside is covered with 1x4-in. ceiling. The roof rafters are trussed and made of 2x6 in. timbers, surfaced on four sides for painting. The rafters of the truss are ceiled with 1x4 in. flooring, the dressed side down. Nailing strips of 1x4-in. timbers placed on 2-ft. spreaders are provided on this ceiling, to which the No. 24 corrugated galvanized iron is nailed. To the bottom chord of the truss the 2x4's surfaced four sides, that carry both clothes pulleys and the No. 18 galvanized iron sheets, are secured. These 2x4's also serve as a stiffening to the bottom chord of the trusses.

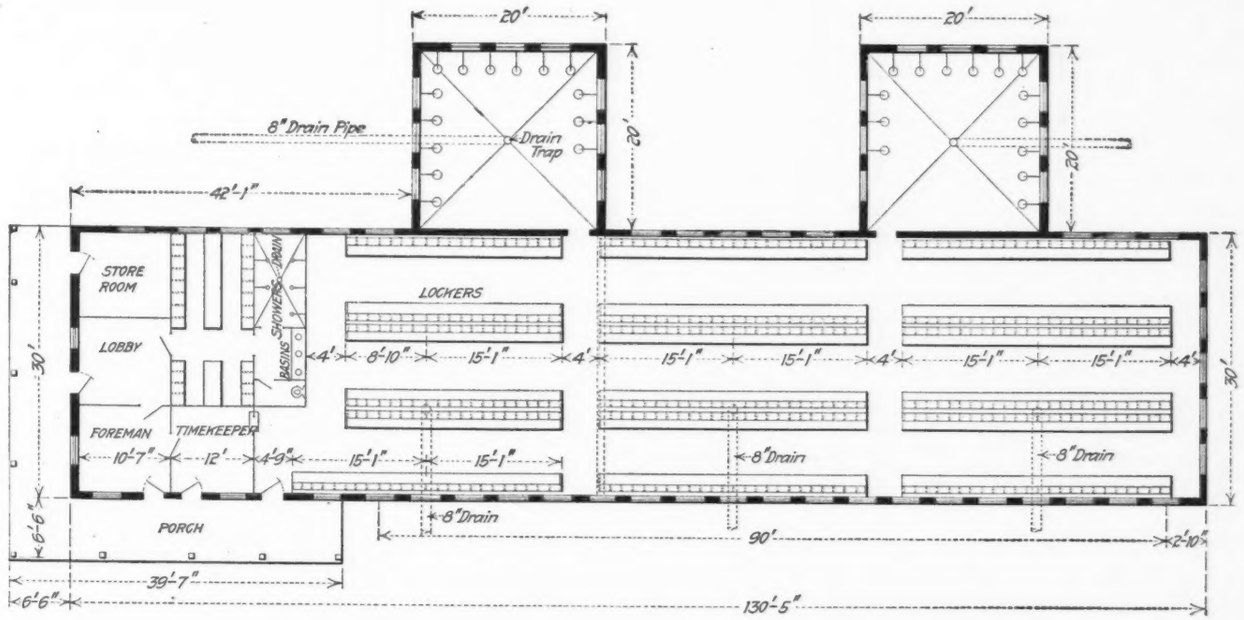



FIG. 1. FLOOR PLAN OF THE COPPER QUEEN CHANGEHOUSE

*Mechanical engineer, Copper Queen Consolidated Mining Co., Bisbee, Ariz.

The ventilators are placed every 10 ft. on the ridge of the roof. They are 16 in. in diameter and are fitted with dampers that can be worked from the floor by means of safety chains. The floor is a 4-in. concrete slab covered with a 1-in. coat of cement. This floor slopes to a common drain under one line of lockers, from which the water is taken off by means of an 8-in. pipe. The construction of the shower room is the same as that of the main changeroom. Fourteen showers are provided in each room, with both hot and cold water. The hot water is heated in a sheet-iron cylinder with steam-heating plant. In this way live steam never gets to the baths. Ventilators are also provided in the roof of the shower room. The water from the shower drains to a trap in the center of the floor, from which it is removed through an 8-in. pipe. The windows are of the double-sized type, each consisting of twelve lights of 10x16 in. glass. The windows are spaced 5 ft. apart. Half-windows are provided over all openings in the office end of the building.

The locker system is worthy of note. The lockers are placed high up, and benches of two pieces of 2x12's are provided under each line of lockers. Hitherto lockers have always been built to take all the clothes and luggage a man might have. Experience with such lockers led to the development of the small locker used in this changehouse. They are made small so that nothing but hats, shoes and ties can be placed in them, thus making a far more sanitary arrangement. The clothes are to be taken

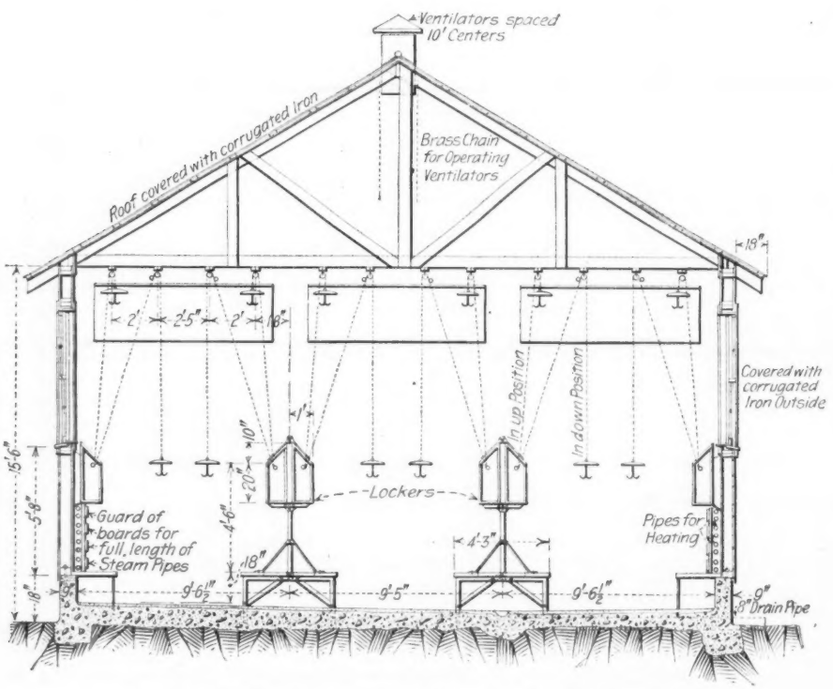

Ventilators spaced 10' Centers
Roof covered with corrugated iron
Brass Chain for Operating Ventilators
Covered with corrugated Iron Outside
In up Position
In down Position
Lockers
Guard of boards for full length of Steam Pipes
Pipes for Heating
9" Drain Pipe

FIG. 2. TRANSVERSE SECTION OF THE CHANGE HOUSE

care of by another method; namely, that of hanging them from the ceiling on hooks and coat hangers. The hooks are made of ½x$\frac{3}{16}$-in. bars, with eye in one end and the other end split and bent up to form two hooks. The bar is bolted to an ordinary coat-hanger and is fastened to No. 2 brass safety chain that passes over a 3-in. screw pulley and then into the locker. Each locker is provided with two clothes-hanging outfits, one for clean and the other for dirty clothes. The lockers are built of 1-in. material, 9 in. deep, 15 in. wide and with an effective height of 20 in. Instead of building the lockers single, they are made in sections of twelve lockers, placed on 15-in. centers. This gives a better method of suspension than could be obtained with single lockers. The usual ventilating holes in both bottom and top are provided. Clothes hooks and two snatches on which to fasten safety chains when in "up" position are part of the locker equipment. The lockers are supported on the same angle-iron frame as the benches, thus giving a neat, clean method of support.

In the office end of the building are the bosses' lobby and changeroom. The lobby is provided for noonday chats and consultations and for the making out of reports. The bosses' changeroom is of the same general style as the main changeroom. The timekeeper's office is situated near the men, and his window opens into the changeroom, which allows the men to report without the necessity of going outside. A small porch is provided about the office end to protect the occupants from bad weather.

## Swiss Chemical Industries

In spite of the difficulty in importing supplies of necessary raw materials, and the additional upset caused by the withdrawal of labor on mobilization, 1916 represented another period of exceptional prosperity for the chemical industries of Switzerland, according to an account published in the *Chemical Trade Journal*, Feb. 3, 1916. The abnormal demands for certain chemical products, due entirely to the war, were met as far as possible by extensions, more or less of a temporary nature, of the existing sources of supply. Where, however, the opportunity presented itself of supplying the demands for goods hitherto obtained almost exclusively from Germany, more permanent developments took place, and the fine chemical and dyestuff industries were the ones more closely affected in this respect. As in 1915, the United Kingdom took the largest share of Switzerland's exports of these products, the transactions being of a reciprocal nature. No figures as to the extent of this trade in the past year are as yet available, but it may safely be assumed that no decline from the value of the previous year has been experienced. A shortage in the supplies of soda ash and other soda compounds stimulated Swiss enterprise, and a soda works erected at Zurzach commenced operations in the fall of 1916. The full productive capacity, however, is not expected to be attained until early in 1917. Another branch of the chemical industry to experience a period of great activity, notwithstanding the scarcity or entire absence of certain raw materials, was the manufacture of electrochemical products. The outputs of calcium carbide and cyanamide, abrasive materials, caustic soda, bleaching powder, nitric acid, and aluminum, with scarcely an exception, were increased, or at least fully maintained, in response to the heavy demands for them.

# Editorials

The McGraw Publishing Co., Inc., and the Hill Publishing Co., of New York, have consolidated as the McGraw-Hill Publishing Co., Inc. The new company acquires all the properties and interests of the two constituents, including the following engineering journals: *Electrical World, Electrical Merchandising, Electric Railway Journal, Engineering Record, The Contractor, Metallurgical and Chemical Engineering, American Machinist, Power, Engineering News, Engineering and Mining Journal,* and *Coal Age.* Two of these papers, the *Engineering News* and the *Engineering Record,* will be consolidated as the *Engineering News-Record,* with Charles Whiting Baker as editor.

The officers of the new company are: James H. McGraw, president; Arthur J. Baldwin, vice-president and treasurer; E. J. Mehren, vice-president and general manager.

The new company will be the largest engineering publishing house in the world.

## Refinement in Chemical Analysis

Dr. W. F. Hillebrand, of the United States Bureau of Standards, in delivering the Chandler lecture not long ago, took as his subject, "Our Analytical Chemistry and its Future." His theme was the need for increased refinement in methods of chemical analysis. Heretofore analytical work has been more or less slipshod. An approximation of the truth plus or minus half a per cent. was near enough. Yet even in mining and metallurgical work during the last 10 years there has been a growing appreciation of the necessity of more accuracy. In buying a carload of zinc ore for which one analyst reports 51% Zn and another 50%, there is no serious inconvenience, nor even loss, in compromising on 50.5%; but when, in buying a mine on the records of drilling, one chemist (expert in the determination of zinc) reports 3% Zn in a sample and another chemist (equally expert) reports 2% in the same sample, it becomes time to pause and take notice. The last was an actual occurrence.

A case was recently brought to our attention, which related to a contract for the sale of an ore containing about 1% of copper. The contract provided that the full amount of copper should be paid for on the condition that it ran as much as 1%. In this case the difference between 0.999% and 1.001% may amount to several dollars per ton of ore, and umpire determinations may be required to settle a difference as small as 0.002% copper.

Of superior importance are requirements for the precise determination of impurities for the control of metallurgical work. E. H. Hamilton, metallurgical manager of the Consolidated Mining and Smelting Co. of Canada, reported recently that in the electrolytic zinc process at Trail it is necessary to eliminate impurities—iron, copper, lead, arsenic, cadmium, etc.—from the electrolyte to less than one part in 100,000. According to Brode, quoted by Jerome Alexander in a recent address before the New York Section of the Society of Chemical Industry, one gram-molecule of molybdic acid in 31,000,000 liters has a detectable catalytic effect upon the reaction between hydriodic acid and hydrogen peroxide.

With some substances the escape of mere traces must be prevented. Thus, in the manufacture of sulphonal there is produced a mercaptan, the odor of which is described as appalling, and so powerful that $\frac{1}{400,000,000}$ milligram may be recognized.

The importance of impurities in some of the great commercial metals, such as steel, copper and lead, is so well recognized that specifications are made and accepted, limiting some of them to the third decimal place.

Another phase of the subject is the existence, as Dr. Hillebrand points out, of rare elements, still chemical curiosities, for which no use has yet been found. Yet rare though they be, like gallium, indium and germanium, and costly as is their extraction, the finding of a use for them will broaden the search for their ores and reduce the cost of production. With use will come a demand for methods of separation and determination, which must be accurate, owing to the small percentages in question or the enormous value of the material.

In order to meet the requirements of such refined analysis, Dr. Hillebrand gives some illustrations of minute details that must receive attention. Thus, in the determination of the electrochemical equivalent of silver, from which the value of the ampere is derived, researches have shown that purity of the electrolyte is of fundamental importance. It was found that the presence in the electrolyte of the organic matter derived from filter paper by the passage through it of the distilled water used was sufficient to cause an appreciable effect upon the structure and weight of the silver deposit.

Many inquiries addressed to the participants in a series of analyses for the establishment of a standard method elicited the information that few knew anything definite about the quality of the water they were using, though examination showed it to be bad in a few instances and on the border line in others. Still less was known as to the quality of the reagents. One admitted that a flaky sediment showed in the ammonia bottle, but he used only the clear liquid above. If the sediment represented silica from the bottle, as it may well have done, what had become of the other constituents of the attacked glass, unless they were in solution?

Dr. Hillebrand, in his work in the Bureau of Standards, has been examining analytical methods and determining reliable standards, although naturally this is a work that can proceed but slowly. As illustrating its nature, the following is cited:

**(1) There are several methods that are in daily use for the determination of phosphorus in steel. Most of them depend on the precipitation of the phosphorus as ammonium-phosphomolybdate, and many are the articles that have been written bearing on the proper conditions for forming and washing the precipitate. The wash liquid used in the alkalimetric method, which is probably the most widely employed of any**

of the methods, is a 1 per cent. solution of the potassium nitrate. Work done at the Bureau of Standards recently has shown that the solubility of the phosphorus-beating precipitate in this wash solution, even in the absence of vanadium, is considerably more than has been suspected. In fact, on a high-phosphorus product, if an attempt is made to wash until the washings are neutral, the result may be several hundredths of 1 per cent. low. This appears to be true whether the phospho-molybdate is precipitated in presence or absence of iron.

2. The so-called evolution method for determining sulphur in iron and steel is one very much in vogue in industrial laboratories because of the short time required for the determination. In it the sulphur is driven out, mainly in the form of hydrogen sulphide, by boiling the alloy with hydrochloric acid and collecting in a solution of a cadmium salt with a view to determining the sulphur by titration of iodine. The method suffers, however, from defects, some of which are understood but others not, as is evidenced by the very discordant results that are reported by different analysts upon the same sample. So far as can be determined, the most discordant results are sometimes obtained by analysts who seem to follow precisely the same procedure. Evidently there is room here for some critical research.

3. Manganese is determined in irons and steels by several methods, of which the bismuthate affords perhaps the most concordant results in different hands when carried out according to certain closely prescribed details of manipulation and standardization of volumetric solutions. There is still doubt, however, as to just what the conditions should be for obtaining a correct end-point in the titration.

4. The methods in use for the determination of tungsten in ferro-tungsten failed completely in a particular instance that was brought to my attention by the chemist of a large steel plant. Works and commercial analysts differed by several per cent. in their reported results. A partial explanation for the agreement was afforded by finding columbium to be present in the alloy, an element hitherto unnoticed and unsuspected in such material. Attempts to devise a convenient and accurate method to meet the conditions have not been very successful, so far as I am aware. Here, again, is room for an interesting study.

5. In the analysis of a brass, one of the Bureau of Standards' series of analyzed samples, somewhat discordant results for lead were reported by different analysts. It was found that those results which had been obtained by depositing the lead electrolytically on the anode as peroxide involved a slight error by reason of coprecipitation of small amounts of silica and stannic oxide, these having been present presumably in the colloidal form in the solution as residuals from the separations that had preceded.

We had occasion recently to investigate methods for the determination of cadmium in brass and inquired of a distinguished brass-works chemist what method in his opinion is the best. He replied that he did not know and implied more or less suspicion of all. In fact, there is considerable uncertainty respecting this determination. Not long ago a matter came up in which it was conjectured that a minute percentage of germanium might be playing a part. A distinguished analytical chemist was requested to make an analysis. He replied that he did not know how and was aware of only two chemists (one of them Dr. Hillebrand, by the way) in this country who did know how. These are some of the interesting problems that confront the analysts of today.

## A One-Thousand-Foot Stack

The interesting and daring design of a 1000-ft. stack for a smeltery described by N. L. Stewart in the *Journal* of Feb. 10, invites comment. The purpose of the design was to determine what the cost of such a stack would be, its benefits in giving great diffusion to smeltery smoke being of course apparent. The total estimated cost was $792,000, and Mr. Stewart concluded with the remark that "this is such a staggering amount that it is doubtful if the benefits from the high stack would warrant such an expenditure."

J. Parke Channing has called our attention to a copy of the *China Press* of Jan. 28, 1916, which was sent to him by M. Eissler, a well-known engineer, who at that time had just completed a trip through Japan and Chosen. The *Press* contained an interesting statement by him of the smoke troubles and remedies planned by the Hidachi mine, which smelts daily about 2000 tons of ore with a sulphur content of 25%. The sulphur smoke causes the mining company much trouble on account of damages to agricultural and rural population, to whom the mine owners have to pay heavy penalties for the destruction, mostly of rice. Although the company had a stack 511 ft. high on top of a hill 1059 ft. high, in order to minimize this nuisance and reduce the damage, it was preparing to supplant this stack with another 1000 ft. high. The inside diameter at the top was to be 33 ft., and its estimated cost was 1,200,000 *yen* (about $600,000).

Although unfortunately no other dimensions of the stack are given, yet structural conditions would require other dimensions to be not dissimilar, and it is very interesting to note how closely these two designs and estimates, made on two different continents, agree. The difference in diameter at the top is only 3 ft., which, of course, would depend largely on the capacity of the smeltery, but while the tonnage of the Salt Lake smeltery for which the stack was designed is not given, the amount of gas to be handled is stated, and the tonnage thereby indicated is not greatly different from that at Hidachi. One was to be of hard-burned perforated blocks, and the other was to be of reinforced concrete. The difference in the estimated cost is not great when it is considered that the lower estimate was made in Japan one year ago, when the price of materials was not nearly so high as at the present, and when it is considered further that the labor item would be much less with Oriental labor than the high cost in Salt Lake Valley. We are not informed as to whether this Hidachi stack has been built, but it seems probable that a 1000-ft. stack for a copper smeltery will become a reality in the not distant future.

## Demurrage on Car Shipments

Owing to the freight congestion in the East and the disarrangement of traffic throughout the country, consignees are experiencing in an extreme degree an inconvenience which is not peculiar to this freight congestion, but is accentuated and increased by it; namely, the bunching of cars en route so that on arrival it is impossible to get them all unloaded before demurrage charges accrue.

There is no legal provision covering this point, but there are many rulings on the subject, as pointed out in a short article elsewhere in this issue. The experience of one mining company in handling this problem satisfactorily to itself might also work elsewhere. Original shipping bills were procured from the shipper and were presented to the railroad agent at the point of destination, and a period demanded for the unloading of each car such as would have been the case had the cars arrived on the same schedule as that on which they were shipped. In the case in point, although the mine was not a large one, the railroad permitted a 30-day account, and when the bills were rendered at the end of that time the manager returned therewith the original shipping bills of the cars which had been received, showing the shipping inter-

val; the railroad waybill showed the dates of arrival; and the delays were credited to the consignee as an allowable unloading period.

Ordinarily, the freight agent at a point where a large mining operation is going on is friendly to the mining interests (otherwise they generally succeed in having him removed), but he is part of the railroad machine and there are matters not left to his discretion and limits beyond which he cannot go, and the demurrage question is generally one. But the railroads being well aware of the decisions cited, are not inclined to be unfair or arbitrary, at least in the face of documentary evidence, and it is probable that the demurrage on cars which have been bunched in transit can always be handled this way.

## BY THE WAY

A large sign in a tourist office in Copenhagen reads: "Safest route to America—via the Trans-Siberian Railroad. Tickets for sale here." The sign is attracting the attention of a large number of Americans in Copenhagen, who have been waiting for several weeks for an opportunity to return to the United States by sea. A trip from Denmark to New York by way of the Trans-Siberian Ry. would cover more than 15,000 mi. The journey would be from Copenhagen to Petrograd, across Russia and Siberia to Vladivostock, thence by way of Japan, across the Pacific and thence across the American continent to New York.

⁂

The executive council of the Association of Chambers of Commerce of Great Britain is to consider proposals for reform of weights, measures and coinage. If a general approval is given, bills to carry out the proposals will be submitted to Parliament. A bill for the establishment of a decimal coinage probably will receive first attention, and the bills for the metric system of weights and measures will not be acted on until the decimal coinage has become familiar. The suggestion is to make the existing florin, which is one-tenth of a pound, the unit and replace the existing farthing, which is 1/96 of a florin, by a cent equal to one-hundredth of a florin.

⁂

Columbia University has offered its entire resources to the Government in event of war and, according to the *Army and Navy Journal,* Secretary of the Navy Daniels and Engr.-in-Chief R. S. Griffin, U.S.N., have approved a tentative plan formulated by a committee on preparedness appointed by President Butler. This plan of linking up the laboratories, hospitals and professional departments of Columbia University with the machinery of military and naval preparedness is extraordinarily comprehensive. A field hospital to be equipped by the College of Physicians and Surgeons, scientific mobilization of the women of the country for economy in the home by Teachers' College, labor and financial proposals by the economics department, and the building of machinery for submarines and motor boats by the engineering department. The following amendment to the constitution of the Columbia University Club, in New York City has been proposed, adding the words: "In case any member shall be also a member of the National Guard of any state or territory and shall be actually engaged in active service for the United States upon the date when a half-yearly instalment of dues becomes payable, the payment of such instalment of dues shall be remitted to such member."

⁂

The following, respecting the copper mines of Serbia, is from the Croatian paper *Hrvatska Kruna* through the New York *Evening Post:*

**The two largest of the copper mines at Majdanpek and Ber are situated in the part of Serbia which is occupied by the Bulgars; the daily output of each of these two mines is three truckloads of pure copper and two truckloads of material used in the manufacture of explosives, which was formerly imported from Spain. The Austrians are working these two mines, but the Bulgars have a share in them. Besides copper, there is lead to be found in Serbia in the Baba mines; the daily output is one truckload of lead and a hundred of sulphuret of lead. Lead is found also in Razanja, at Crveni Breg, and at Rudnik, where there is copper as well.**

We gather from this that the Bor mines are now being worked again and are producing three carloads (European) of blister copper per day. The "material used in the manufacture of explosives, which was formerly imported from Spain" is probably pyrites. The Baba mines are apparently producing one carload of pig lead and a hundred carloads of galena ore.

⁂

## February Mining Dividends

Dividends paid in February, 1917, by 25 United States mining and metallurgical companies making public reports amount to $12,812,268, as compared with $7,935,089 paid by 26 similar companies in February, 1916. Holding companies allied to mining paid $340,000, as compared with $220,000 in 1916. Canadian and Mexican mining companies paid $2,186,851 in 1917, as against $1,324,677 in 1916.

| United States Mining and Metallurgical Companies | Situation | Per Share | Total |
|---|---|---|---|
| Am. Zinc, Lead and Smelt | U. S. | $1.00 | 228,120 |
| Am. Zinc, Lead and Sm., pfd | U. S. | 1.50 | 144,840 |
| Anaconda, c | Mont. | 2.00 | 4,662,5[illegible] |
| Arizona Copper | Ariz. | .36 | 547,1[illegible] |
| Boss, g.p | Nev. | .02 | 8,240 |
| Bunker Hill & Sullivan, l.s | Ida. | .50 | 163,500 |
| Caledonia, l.s | Ida. | .03 | 78,150 |
| Champion, c | Mich. | 6.40 | 640,000 |
| Chief Con., c | Utah | .05 | 44,201 |
| Cresson, g.s | Colo. | .10 | 122,000 |
| Electric Point, l | Wash. | .01 | 7,938 |
| Golden Cycle, g | Colo. | .03 | 45,000 |
| Hecla, l.s | Ida. | .15 | 150,000 |
| Homestake, g | S. D. | .65 | 163,254 |
| Internal. Nickel, pfd | U. S.-Can. | 1.50 | 133,689 |
| Jim Butler, g | Nev. | .10 | 171,802 |
| Mass Con., c | Mich. | 1.00 | 100,000 |
| Miami, c | Ariz. | 2.00 | 1,494,222 |
| Mohawk, c | Mich. | 10.00 | 1,000,000 |
| New Jersey Zinc | U. S. | 4.00 | 1,400,000 |
| Shannon, c | Ariz. | .50 | 150,000 |
| United Verde, c | Ariz. | 1.50 | 450,000 |
| United Verde Ex., c | Ariz. | .50 | 525,000 |
| Utah Metal & Tunnel | Utah | .50 | 342,650 |
| Wilbert, l.s | Utah | .01 | 10,000 |
| Yellow Pine, s.l | Nev. | .03 | 30,000 |
| **Holding Companies** | **Situation** | **Per Share** | **Total** |
| St. Mary's Min. Land | Mich. | $2.00 | $320,000 |
| White Knob, c | Cal. | .10 | 20,000 |
| **Canadian and Mexican Companies** | **Situation** | **Per Share** | **Total** |
| Amparo, g.s | Mex. | $0.05 | $100,000 |
| Asbestos Corpn., of Can., pfd | Que. | 1.00 | 40,000 |
| Coniagas, s | Ont. | .25 | 200,000 |
| Granby Con., c | B. C. | 2.50 | 374,963 |
| Greene-Cananea, c | Mex. | 2.00 | 976,888 |
| Hollinger, g | Ont. | .05 | 240,000 |
| McIntyre-Porcupine, s | Ont. | .05 | 180,000 |
| Temiskaming, s | Ont. | .03 | 75,000 |

The dividend by McIntyre-Porcupine was initial.

Total dividends in the first two months of the year paid by United States mining and metallurgical companies amount to $26,272,734; by holding companies, $1,340,000; by Canadian, Mexican and Central American companies, $3,826,199.

## Personals

**Frank H. Sistermans,** late of El Paso, now has an office at 60 Broadway, New York.

**E. Norris Hobart** has gone to Hermosillo Sonora, Mexico, to examine copper properties.

**D. W. Brunton** sailed on Feb. 12, from San Francisco, on the "Ecuador," en route for China.

**Seeley W. Mudd** has been elected second vice-president of the Los Angeles Chamber of Mines and Oil.

**Clyde T. Griswold,** of the Associated Geological Engineers, Pittsburgh, is examining mining fields in Oklahoma.

**J. D. Sperr** has severed all connections in the Jerome, Ariz., district and will be temporarily situated at Houghton, Mich.

**Arthur S. Dwight** has been commissioned Major (Engineers) in the Officers Reserve Corps to date from Jan. 23, 1917.

**A. Bodelson** of Sumpter has purchased 200 acres of placer land in Powder River Valley, extending to northern city limit.

**J. F. Kellock Brown** has joined Arthur D. Little, Inc., as mining engineer. His present address is 137 McGill St., Montreal.

**Charles J. Adami, Bartlett L. Thane** and **C. M. Weld** have been elected to membership in the Mining and Metallurgical Society of America.

**John F. Spedding** is manager for the New Gangpur Mining Syndicate, Ltd., Gariajore Mines P. O., via Rajgangpur, B. N. R., India.

**G. Robert De Beque** has severed his connection with the Progress Mining and Milling Co., and will enter the oil, gas and oil-shale business at De Beque, Colo.

**G. M. Ratliff,** heretofore assistant engineer of maintenance of the Southern Ry., has been appointed office engineer of the system, with headquarters at Washington, D. C.

**W. L. Creden,** of Butte, Mont., made an address to the members of the Standard Stock Exchange, Toronto, on Feb. 22, on the Butte mining camp and its development from a silver to a copper- and zinc-bearing district.

**William H. Leerpabel,** an American mining engineer operating at the Carlota mine, near Cienfuegos, Cuba, is reported to have been wounded by Cuban rebels, and the United States minister has been asked to secure the punishment of those guilty of the offense.

**Adolph Knopf,** of the United States Geological Survey, left recently for the Rochester district of Nevada, where he will spend three months in making a detailed geological survey of the small area in which the principal operations in that district are confined.

**R. H. Sweetser,** for some time president of the Thomas Iron Co., Hokendauqua, Pa., has been made works manager of the Columbus Iron and Steel Co., Columbus, Ohio. He was superintendent of that company's furnaces before engaging with the Thomas Iron Co.

**S. Coles Peebles** has been elected general manager of the Ashland Iron and Mining Co., Ashland, Ky., and will have charge of its steel plant now under construction. Mr. Peebles is closely identified with large interests in the vicinity of Ironton and Portsmouth, Ohio.

**John C. Jay, Jr.,** formerly vice-president of the Pennsylvania Steel Co., and chairman of the board of the Maxwell Motor Co., has joined the firm of Jamieson, Houston & Graham, consulting engineers, 40 Wall St., New York. The firm will hereafter be known as Jamieson, Houston, Graham & Jay.

**John O. Pew,** who retired, Feb. 15, as president of the Youngstown Iron & Steel Co., was given a dinner in the Hotel Ohio, Youngstown, last week, attended by about 90 employees. Mason Evans, treasurer, acted as toastmaster and presented Mr. Pew with a diamond stickpin as a gift from the employees.

**Dr. L. D. Ricketts** was the guest of honor at the annual dinner, given at the Princeton Club, New York, on Feb. 6. Dr. J. G. Hibben, president of Princeton, was present and made an address. Dr. Ricketts was graduated from Princeton with the class of 1881. He expects to make his home in Princeton, and has purchased a house there.

**Eric T. King** has been appointed assistant secretary of The General Contractors' Association, New York. Mr. King was, for ten years, an assistant engineer on the Catskill Water System for New York City, and latterly has been assistant to Lederle & Provost, Consulting Engineers. He was graduated from Union College in 1905.

**John A. Davis,** superintendent of the Fairbanks, Alaska, mining experiment station, left Washington last week for an inspection tour of all the Bureau of Mines' stations. By familiarizing himself with the work of the other stations duplications of effort will be avoided, it is believed. Mr. Davis expects to reach Fairbanks June 15.

**Edmund S. Leaver,** of Salt Lake City, has been appointed metallurgist for the Tucson mining experiment station of the Bureau of Mines. Mr. Leaver's technical education was obtained at the University of Utah, where he was a student from 1889 to 1894. Since leaving the University he has worked as a metallurgist with Charles Butters and Co., Inc.; Dexter Tuscarora Mining Co.; Nevada-Goldfield Reduction Co.; Daisy Combination Mining Co.; Knight-Christensen Metallurgical Co., and the Tintic Milling Co. He reported for duty February 1.

## Societies

**American Society for Testing Materials** will hold its 20th annual meeting at Atlantic City, at the Hotel Traymore, June 26 to 30, inclusive. The effect of the increase in dues in 1916 is that instead of an estimated deficit of $7500 otherwise expected at the close of the year, the increase has brought about a surplus of $1785. The membership has also shown a gain, the increase for the year being 171, compared with, however, a net increase for 1915 of 208. The present total membership is 2132.

**Canadian Mining Institute** will hold its 19th annual meeting at Montreal, on Wednesday, Thursday and Friday, Mar. 7, 8 and 9, 1917. A large list of interesting technical papers has been prepared for presentation. The annual dinner will be held on the evening of Mar. 8, at the Ritz-Carlton Hotel. By the courtesy of the managements of respectively the Canadian Vickers, Ltd., the Dominion Copper Products Co., and the Montreal Ammunition Co., members will be afforded the opportunity of visiting the munition plants of these companies.

**Northern Minnesota Engineers' Club** held its third annual banquet at the New Fay Hotel, Virginia, Minn., on Jan. 20. T. E. Charlton, of the Oliver Iron Mining Co., was elected president. Edward Scallon, of Virginia, was toastmaster, and among the speakers were C. N. Boss, Duluth; B. A. Middlemiss, F. A. Wildes, Hibbing; Past President Downing, Robert Downing, Keewatin; President-elect Charlton. One hundred engineers attended the banquet. Entertaining numbers were furnished by vaudeville teams from local theaters.

**Northwest Mining Convention** was held at Spokane, Wash., Feb. 19 to 25. The technical program was in charge of the Spokane Engineering and Technical Association, assisted by the Columbia Section of the American Institute of Mining Engineers, the Spokane Section of the American Institute of Electrical Engineers, and the Spokane Section of the American Society of Civil Engineers. An interesting technical and social program was provided, and the meeting was largely attended by engineers from all over the West. A number of representatives from the East were also present.

**Chemical Engineering Catalog** is another of those constantly recurring instances of the typical American tendency to do something in a radically better way than it has ever been done before, and at the same time to do it more cheaply by doing it more scientifically. The catalog is a standardized collection of the advertising matter of the various manufacturers of chemical engineering apparatus and supplies, and will eventually contain in a single volume practically all of the available information on raw materials, equipment and supplies which previously has demanded the maintenance of an extensive file of manufacturers' catalogs and an elaborate filing system. In order that the catalog may be of maximum value to those interested, its preparation is under the supervision of a committee on which are representatives of the American Institute of Chemical Engineers, the American Chemical Society and the New York Section of the Society of Chemical Industry. In order to broaden the scope of this supervision, the American Electrochemical Society has been asked to name representatives to act on this commmittee.

**American Institute of Mining Engineers**—The semi-annual meeting of the Montana Section of A. I. M. E. was held at the Silver Bow Club, Butte, Mont., on Friday, Feb. 2, 1917, at 8 p.m. An informal dinner was served earlier in the evening to sixty-two members and guests. Chairman J. L. Bruce called the meeting to order and talked a few minutes on membership in the Institute, and the activities of the Naval Consulting Board. C. W. Goodale spoke at length regarding contributions for the relief of Belgian children, with an appeal to the members of the Institute to respond in appreciation of the work of H. C. Hoover. The following officers were chosen for the ensuing year: Chairman, W. C. Siderfin, Butte; vice-chairman, Oscar Rohn, Butte; secretary-treasurer, E. B. Young, Butte; executive committee, C. D. Demond, Anaconda; F. W. Bacorn, Butte. An interesting paper was given by L. D. Frink, superintendent of the Speculator mine, upon the applications of mine ventilation in Butte. Several exhibits and photographs, showing the operation of the canvas tubing, etc., added to the interest of the talk. Discussion followed by Messrs, Goodale, Bruce, Dunshee, Bacorn, Warner, and Simons. F. A. Linforth of the A. C. M. Co. Geological Department exhibited a number of models and maps showing features in the graphic interpretation of geological problems. Discussion by Mr. Dunshee, of the A. C. M. Co., indorsed the value of such work to the mining department.

## Trade Catalogs

**Yuba Centrifugal Pumps.** Yuba Mfg. Co., 433 California St., San Francisco, Cal. Pp. 48; 7x10 in. This contains blue prints showing sections and tables of dimensions, etc.

**Motor Trucks of America.** The B. F. Goodrich Co., Akron, Ohio. This is the fifth annual volume of this publication and contains photographs and specifications of different makes of motor trucks, also an article entitled "Lengthening the Life of the Motor Truck." This book ought to be useful to those interested in motor trucks. Pp. 164; 7x10 in.

## Industrial News

**Electric Fans.** Westinghouse Electric & Mfg. Co., E. Pittsburgh, Penn. Catalog 8-A. Pp. 28; 9x11 in.; illustrated.

**Blaw Steel Construction Co.,** Pittsburgh, Pa., has opened an office in the Rialto Bldg., San Francisco, Cal. Edward M. Ornitz is in charge

**Air Compressor, Rock Drills, Mining Pumps, etc.** Rix Compressed Air & Drill Co., San Francisco, Cal. Bulletin 144A. Pp. 48; 6x9 in.; illustrated.

**Walter A. Zelnicker Supply Co.,** St. Louis, Mo., has purchased the Idaho Southern R.R., which runs from Gooding to Jerome. Idaho and the Milner & North Side R.R., a short line extending from Milner to Oakley, Idaho, comprising a total of approximately 50 mi. These railroads were built only a few years ago by Pittsburgh capital. It is understood the Walter A. Zelnicker Supply Co., will dismantle the roads and sell the rails and other equipment, which are practically new.

## New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

**Agitator** for treating mineral oils. Julius Hansen, Coffeyville, Kan. (U. S. No. 1,215,526; Feb. 13, 1917.)

**Aluminum Hydroxide**—Process for the Manufacture of Hydroxide of Aluminum. Botho Schwerin, Frankfort-on-the-Main, Germany, assignor to Elektro-Osmose Aktiengesellschaft (Graf Schwerin Gesellschaft), Frankfort-on-the-Main, Germany. (U. S. No. 1,216,371; Feb. 20, 1917.)

**Blast-Furnace Practice**—Preheating of Air for Hot Blast Stoves of Blast Furnaces. Edward E. Marshall, Philadelphia, Penn. (U. S. No. 1,217,039; Feb. 20, 1917.)

**Casting Pot.** Grenville Mellen, East Orange, N. J. (U. S. No. 1,216,341; Feb. 20, 1917.)

**Concentrator.** Joseph B. Green, Seattle, Wash., assignor to G. A. Henkel, Arlington, Ore. (U. S. No. 1,216,798; Feb. 20, 1917.)

**Dust Separator**—Separator. Milton L. Hickman, Rapid City, S. D. (U. S. No. 1,215,935; Feb. 13, 1917.)

**Electro-Metallurgy**—Changeable Vault Structure for Electric Melting Furnaces. Bernhard Christian Kværnö, Haugesund, Norway. (U. S. No. 1,216,331; Feb. 20, 1917.)

**Ferrophosphorous**—Process of Producing Ferrophosphorous from Nelsonite. John Jefferson Gray, Jr., Rockdale, Tenn. (U. S. No. 1,216,306; Feb. 20, 1917.)

**Gases**—Apparatus for Purifying Blast-Furnace Gases. Martin Ernest Fellmann, Donald Bagley and Arthur Herbert Smith, London, England. (U. S. No. 1,216,677; Feb. 20, 1917.)

**Gases**—Filtering Medium for Cleaning Furnace Gases. Fred E. Kling, Youngstown, Ohio, assignor of one-half to Luther B. Weidlein. (U. S. No. 1,215,385; Feb. 13, 1917.)

**Malm Process**—Barrel. John L. Malm, Denver, Colo. (U. S. No. 1,215,565; Feb. 13, 1917.)

**Ore Treatment**—Process of Treating Ores. George F. Downs, Buffalo, N. Y. (U. S. No. 1,216,667; Feb. 20, 1917.)

**Potash**—Process for Obtaining Potash from Potash-Rocks. Frederick C. Gillen, Milwaukee, Wis., assignor to William A. Krasselt, Milwaukee, Wis. (U. S. No. 1,215,517, 1,215,518; Feb. 13, 1917.)

**Pump**—Valve-Seat for Mine-Pumping Conduits. Daniel F. Lepley, Connellsville, Penn. (U. S. No. 1,216,144; Feb. 13, 1917.)

# Editorial Correspondence

### SAN FRANCISCO—Feb. 22

**Yuba Manufacturing Co.**, formerly known as the Yuba Construction Co., has formally offered to the United States, in case of war, the use of its two manufacturing plants at Marysville and Benicia. These plants manufacture dredges, tractors, pumps and other machinery, and are equipped for the manufacture of some of the essential requirements of the Government in the event of war. Both plants were surveyed by the United States Government as part of the preparedness program. When the Mexican trouble was at a point requiring this sort of assistance, the plant at Marysville was offered to the Government for the production of Yuba tractors.

**Weather Conditions** have lately been more favorable for mining during the coming season. The long period of dry cold weather was broken last week by a hot spell of two or three days, quickly followed by cold and rain on Feb. 17. Hydraulic mining in some of the northern counties was interrupted by freezing weather and there have been also interruptions of quartz mining where the water supply is taken from open ditches and through surface pipes. There has been no great damage resulting from the extreme cold weather, but a little of it will now go a long way and is not at all essential to the progress of mining or the happiness of the mining men.

**Mother Lode Mine Safety Association** was formed last month at a meeting held at Sutter Creek, Amador County, called at the suggestion of Edwin Higgins, safety engineer of the California Metal Producers Association. The action was participated in by mine managers and superintendents. Monthly meetings will be held for discussion and exchange of views and suggestions looking to the improvement of safety conditions in the mines and mills; the foremen, shift bosses, mill superintendents and others will be invited to take part. Methods of prosecution of safety work and various needs of mine communities were discussed at the first meeting, including better housing of miners and adequate hospital service. First-aid and mine-rescue training also occupied the attention of the meeting. Plans will be made for holding public meetings for the delivery of addresses or lectures on mine safety and rescue work, to be illustrated by moving pictures. The interest manifested by miners as well as superintendents and foremen in the subject of practical safety measures is rapidly reducing the probability of accidents resulting from carelessness or negligence. Some interesting reforms have been adopted by the mines along the lode in Amador County. A central safety committee meets once a month to discuss suggestions and consider ways and means to prevent accidents. Each mine has a safety inspector and sends a committee of miners through the mine each month to make exploration and recommendation for safety. All of the mines have bulletins and suggestion boxes, and warnings and admonitions around the yard. Never in the history of the Mother Lode has such a campaign for safety been conducted. There is no doubt that it will result in an appreciable reduction of accidents.

### BUTTE—Feb. 23

**Anaconda Extensions** are attracting attention. At the Washoe Reduction Works in Anaconda, excavation was begun Feb. 15 for an extension of the sulphuric-acid plant. The addition will be housed in separate buildings just north of present plant. Combined capacity at the beginning of operations will be 180 tons of acid per day, 140 tons of which are now being furnished by the original plant. It is also expected that a new stack may be built for the Washoe smeltery to take place of or act in combination with old stack. Dimensions of proposed stack have been reported as 535 ft. high by 50 ft., inside diameter, requiring 30,000,000 brick and involving addition to the brick-making plant at Anaconda. This would be the highest stack in the world. As a matter of fact, however, no details have been decided and the stack has not yet been authorized. The December accident record in Anaconda's Butte mine shows only 24 serious accidents in 338,036 shifts; of the 28 operating shafts, 13 had a clear score. Anaconda's option on the Douglas mine in Cœur d'Alene district, Idaho, expires within next 60 days. Indications are to the effect that company will either take up option or take another extension. Compressor has been installed at the mine and considerable ore blocked out. Shipments have steadily increased and now average 50 tons a day.

**Barnes-King Operations** interest many people in Butte, as well as other stockholders throughout the state. The report for 1916 just issued shows good progress was made in the uphill battle that the present management has been waging. The company met with many difficulties even during the last year but some of these troubles have now been cleared up. The net operating profits in 1916 were $96,338 as compared with $147,968 during 1915. Decrease is accounted for by diminished returns from the North Moccasin properties and increased losses in Piegan-Gloster properties in Lewis and Clark County, although the latter showed a profit of $20,000 during the last four months of the year due to better grade of ore and higher recovery. Profits from Shannon property have all been applied to purchase price. During period, $58,000 were paid out for additional claims and equipment and $100,000 for the Kendall property in Fergus County, which made it necessary to borrow $90,000, of which $15,000 was repaid prior to Dec. 31, 1916. At close of year the company had balance on hand of $109,120 consisting of $34,726 in cash, balance in bullion in transit. Production at North Moccasin was 33,715 tons of an average grade of $8.65 per ton. A total of 14,918 tons of ore was mined and milled at the Kendall mine of an average grade of $2.50 per ton. At Piegan-Gloster and Shannon mines 35,536 tons of average grade of $9.48 were mined and milled during year.

### DENVER—Feb. 22

**Dangerous Flooding of Penrose Shaft** at Leadville resulted from such a simple thing as the temporary shutting-off of water from one of the Leadville Water Co.'s minor branch lines. This created some expensive havoc in the Penrose workings and almost resulted in the death of a number of miners. The great Providence centrifugal pumps in this mine must keep going every minute to prevent flooding the mine. The bearings of these high-speed pumps are cooled by pure water taken from the city main. About noon of Feb. 21, the pumpmen noticed that this water was not flowing, and it became immediately necessary to stop the pumps. Thinking the water service would be soon resumed, no warning was sent to the men working in distant parts of the bottom level. The water rose rapidly and within one hour the station was more than half full and extended far enough back into the level to apprise the men of their danger and they promptly made their escape by long, strenuous deep wading and swimming. Fortunately the city water was turned on in time to prevent the drowning of the motors which are mounted above these mammoth pumps, and the three pumps were soon throwing about 4000 gal. per min. to the surface.

**Mine Taxation** is a vexatious problem and Colorado has had its share of the controversies that arise as to what is a fair basis of assessment. The law passed two years ago basing a mine's valuation upon both its gross and net outputs has proved far from satisfying. At the annual conference of the Colorado Tax Commission, held in Denver this week, J. C. Ferrill, assessor of Teller County (Cripple Creek district), recomemnded that mines be assessed at their full value. He proposed that a mine's full valuation be considered a direct function of its net returns per year, and he suggested that it be fixed at about 4 or 5 times this profit. In other words, he would argue that the profits from mining are about 20 or 25% of the full value of the property. This is not good doctrine when viewed from a mining-engineering standpoint, but does provide a tangible basis for tax assessment and it will be fairer than most proposals because it will fluctuate with the profits, though it will be hard on expiring mines or those of short life. Mr. Ferrill also proposed that non-producing properties be assessed at a value per acre that is not less than the Government's sale price, which for lode ground is $5 and for placer is $2.50. His remarks were commended by the commission.

### SALT LAKE CITY—Feb. 23

**Output of Utah Copper Co.**, restricted by bad weather during last three months, is gradaully returning to the high rate of production of 1916, when the average daily tonnage milled was 31,000 tons. The tonnage, which during the worst weather reached the low point of about 20,000 tons daily, has been increased to 28,000 tons a day. At the mine, 16 out of the 22 steam shovels are now working. The January production is roughly estimated at 13,500,000 lb. of copper.

**Mining Taxation in Utah** is still under consideration, and a resolution proposing an amendment to the state constitution fixing the assessment and taxation of mining claims and property at their full money value, assessment to be made by the State Board of Equalization, has just been voted by the House. If the Senate concurs in the action of the House, the proposed amendment will come before the voters at the next general eiction in November. It takes the place of a former proposed amendment—previously discussed in these columns—to tax mines at three times their net proceeds, permitting the taxing authorities to place their own valuation on the surface ground of nonmetalliferous mines. Mines are at present taxed according to the price paid the Government for surface ground of patented claims, machinery and surface improvements at their value, and net annual proceeds at value. As will be seen, the new method proposed leaves the fixing of value as before in the hands of the State Board of Equalization. General opinion among mining men and mine owners is opposed to these changes.

### PHOENIX, ARIZ.—Feb. 23

**State Smelting** is proposed in one of the new bills now before the Arizona legislature. The Foster Bill provides for the establishment of a state smeltery to be under charge of a board of directors of five members, with qualifications specified only in that not more than three shall belong to the same political party, all to be appointed by the governor, to be confirmed by the senate and to have a 4-yr. tenure of office. The directors shall constitute a body corporate, "with the powers of a corporation engaged in the industrial pursuit of smelting ore reduction works, including the right of eminent domain," though not permitted to become endorser on any obligations. The directors shall receive $10 a day each for actual service, with 10c. mileage and shall be bonded in $25,000 each. Organization of the directorate shall be at once and choice then shall be made of a suitable site for the smeltery and of plans for the building of works that shall cost, exclusive of the site, not more than $750,000. Construction is to be "with the utmost speed." No provision is made for securing the necessary funds, save that they shall come from the general fund, which shall be repaid by the setting aside of half of the profits of the smeltery, which is to do business on a 10% margin; the other half of the prospective profits shall be applied to betterments and extensions. The bill is to have favorable report this week from the house committee on mines. It is rumored that an attempt will be made to change it to provide only a state sampling works. The smeltery bill has been introduced in the senate by Chairman Mahoney of the committee on labor. While favored by labor-union sentiment and based upon a provision of the constitution permitting the state to engage in industrial pursuits, it is insisted that the measure is backed especially by small mine owners who now are unable to get their ores treated in the present reduction works of the Southwest. Just how the state would be able to provide capacity more readily than the established companies is not explained and it is entirely likely that before a state plant could be built, it would be found that there was an excess of smelting capacity and that the limiting feature in copper production is in the refining capacity.

### JEROME, ARIZ.—Feb. 21

**Labor Unrest** is in the air; I. W. W. agitators and unionists are working in the district. It is said that at the United Verde offices, the labor situation has already been seriously discussed and that if a strike is called the mine will be closed at once; also, the union is reported to have taken a strike vote but no results have been announced. Some labor unrest has been apparent for months. The general feeling among the men is that wages are too low in this camp compared to living expense. The United Verde and United Verde Extension both pay on a sliding scale based on the price of copper. What the result is going to be is hard to guess. A strike now would be the last straw for Jerome. Probably all work would be suspended and the strikers would be given the privilege of amusing themselves as they saw fit. New development would come to a standstill.

### JOPLIN—Feb. 24

**Extensive Operations by Butte & Superior** in the Kansas section of the Joplin district have just been announced. Some months ago, through Victor Rakowsky, this company obtained leases on 4300 acres of land directly north of the Eagle-Picher Lead Co.'s operations in Oklahoma. This big acreage, which is virtually in one solid block, lies entirely in Kansas, being bounded on the east by the town limits of Baxter Springs, Kan., and on the south by the Kansas-Oklahoma

state line, to which the Picher lands extend. Under the name of a subsidiary organization called the Miami Zinc Syndicate, the Butte & Superior company has been drilling portions of the tract and has located one mill site 1 mi. west of Baxter, where shaft sinking and mill building is to start within a few weeks. From 10 to 15 churn drills are being kept at work on the tract, and portions of it will be subleased in order to hasten full development to the utmost. Drilling to date is authoratively stated to bear out theory that the Oklahoma mineralization extends through this territory. Victor Rakowsky interested the Picher company in the tract to south where development has been extraordinary during the last two years. G. M. Burke, of Joplin, is local manager for the Butte & Superior interests, and will be actively in charge of development. He is nominally manager for the Continental Zinc Co., another Butte & Superior subsidiary, which has long operated in Joplin camp. J. L. Bruce, now manager for Butte & Superior at Butte was formerly manager of the Continental Zinc Co. here.

### DULUTH, MINN.—Feb. 24

**Tonnage-Tax Bill** passed the lower branch of the Minnesota legislature by a vote of 69 to 61. It will next be taken up by the senate, where it is believed the measure will meet defeat. A vote was secured in the house after only a few hours' debate, and it is generally believed before the vote was recorded that the bill was doomed. The tonnage-tax advocates, however, had mustered sufficient votes to get the bill through. The bill provides for a super tax of 2% on all "merchantable" iron ore at the mouth of the mine.

### IRONTON, MINN.—Feb. 23

**I. W. W. Strike on Cuyuna Range** focuses attention on the labor situation that is to confront Lake Superior mine operators with the opening of the new season. The present strike is at the Wilcox mine of the Canadian Cuyuna Mining Co. at Woodrow. Approximately 100 men walked out Feb. 19, demanding the abolition of the contract system and substitution of the following wage schedule: Trammers, $3.50; miners (dry places), $3.75; miners (wet places), $4. Deputy sheriffs from Brainerd are stationed at the mine to protect property and preserve order as violence has been threatened to anyone returning to work. The mining company will keep its mine idle until the men are willing to return to work under the contract system. This may be the forerunner of a general strike on the Cuyuna range which prominent mining men think will be called early this spring. The highest wages in the history of the Cuyuna range are being paid to the miners. At the Wilcox mine, where the miners are on a strike the lowest paid miner under the contract system was $3.85 per day for the month of January, yet under the guidance of the silvery tongue I. W. W. organizers they ask for the abolition of the contract system, set a lower wage schedule, call a strike and then fill the coffers of the Haywood crowd.

### TORONTO—Feb. 24

**Power Plant at Gowganda,** on which work has been begun, will provide an ample supply of electric energy to the mines of this district. It is expected that the construction of a dam at Hanging Stone Falls and the diversion of the water of the East branch of the Montreal River through a 6500-ft. tunnel into Hanging Stone Creek wil render possible the development of 1500 hp. The power plant will be situated at the south end of Gowganda Lake and will contain three units of 500 hp. each. The enterprise is being promoted by Buffalo and Philadelphia interests and will involve an expenditure of about $250,000.

**Kirkland Lake Developments** continue to be highly satisfactory. At present the Tough-Oakes is the only producer, but within the next few days the Teck Hughes property will commence milling. In addition to these two properties, developments on the McKane, Lake Shore and Wright-Hargraves properties indicate that they will become profitable mines. The Beaver Consolidated of Cobalt has made the first payment of $75,000 on the McKane property in Kirkland Lake, which it has under option. During the last year a shaft has been sunk to a depth of 500 ft., and crosscuts driven into the vein at every 100 ft. The ore is reported to average $18 over a width of 5 to 6 ft. A larger mining plant was ordered recently.

**Labor Conditions Continue Acute** throughout northern Ontario. Committees of the labor unions are meeting to draw up wage schedules for the various camps, and it is understood that they propose to ask for a $4 flat rate for drill runners, $3.75 for helpers and $3.50 for muckers. While some of the more prosperous companies in Cobalt can pay these wages, it is an entirely different question in Porcupine, where the price of the product has remained constant, while the cost of material and supplies has increased greatly. Indications point to a strike in Porcupine, where the operators claim that with the increased cost of supplies and the decreased efficiency of labor, it would be preferable for them to close the mines rather than to increase wages. It appears that the miners will also make a demand for the recognition of the Western Federation, and if this point should become a real issue, there seems to be no question but that the operators in all the camps would fight rather than recognize this union.

**Hollinger Dividend Reduction** is presaged. While official announcement has not yet been made, it is definitely understood that the Hollinger Consolidated Gold Mines proposes to cut the dividend from 13% a year to 6½%. This reduction is stated to be only temporary and that when normal conditions return the shareholders will be reimbursed for the reduction. Hollinger is in the unfortunate position of having kept the mill capacity and dividend payments in advance of the mine development, and the acute labor situation now prevailing in the Porcupine district is the reason for their being unable to catch up. It is also generally thought that the capital of $25,000,000 for the amalgamated companies is too great. Since this amalagamation went into effect, Hollinger profits have not been sufficient to meet the dividends. The mill capacity is being increased to 3000 tons per day, and had the mine been able to get all the men it needed it would have had little difficulty. Labor is, however, so scarce that the company is barely able to raise the tonnage required for the present mill, and until labor conditions improve there seems little chance of the company being in a position to feed a larger mill. Hollinger is, however, a great mine, and will eventually be able to work itself out of the present unfortunate position.

### MELBOURNE—Jan. 24

**Foreign Mining Investments** have appealed to certain Australian investors more than some of the local operations. For some years Australians have been largely interested in tin mining in the Malaya and it is now interesting to note that they are extending their interests to another field. T. H. Martyn, of Sydney, one of the directors of the Malaya Tin Corporation, has recently returned from Siberia where he acquired interests in alluvial and lode gold areas in the provinces of Yenessi and Tomsk. A plant has already been forwarded from Australia to one of these properties, the Savanick, of which G. V. Piper is the superintending engineer.

# The Mining News

## ALASKA

HANDY ANDY GOLD MINING (Chichagoff)—Development, by sinking and drifting, in progress at this property across the bay.

SEA LEVEL COPPER (Chichagoff)—Development suspended for winter at depth of 200 ft. in this property at Tidewater, about 18 mi. north of Chichagoff.

CHICHAGOFF MINING (Chichagoff)—Running 30 stamps and employing 140 men. Ore free milling; 93% of the gold being recovered; occurs in shear zone in graywacke; worked to depth of 2200 ft. James L. Freeburn, superintendent.

ALASKA ENGINEERING COMMISSION (Anchorage)—Bringing additional equipment from Panama Canal as follows: Seven small locomotives of 3-ft. gage, 10 standard locomotives, 100 flat cars of 80,000 lb. capacity, two Lidgerwood unloaders, one Mann-McCann spreader and two 70-ton steam shovels. Has lately purchased from U. S. Steel Products Co. 1300 tons of 50-lb. rails at $38 per ton for Nerana-Fairbanks division.

## ALABAMA

GENERAL GRAPHITE CO. (1823 Jefferson Bank Bldg., Birmingham, Ala.)—Incorporated in Delaware for $1,500,000 to operate graphite-bearing lands, about 10,000 acres, in North and South Carolina, and to manufacture finished graphite products. J. Standish Clark, general manager.

## ARIZONA

### Gila County

OLD DOMINION (Globe)—To simplify corporate matters, directors of Old Dominion Copper Mining and Smelting Co. have voted to dissolve that New Jersey corporation and sell its remaining assets to Old Dominion Co. of Maine, which already owns most of the Jersey corporation's stock and all of that of the United Globe Mines Co.

### Greenlee County

ARIZONA COPPER (Clifton)—This company's production for January was 4,100,000 lb.

### Mohave County

SCHENECTADY (Chloride)—Telluride & Chloride Leasing, Mining and Milling Co., operating this mine, is installing a 40-hp. Fairbanks-Morse gasoline engine, Ingersoll air compressor and Denver rock drills. Shaft now 190 ft. deep; will sink to 300 ft. H. L. Heath, president. Bulkeley Wells, of Smuggler-Union Mining Co., Telluride, Colo., recently purchased a block of stock and has optioned additional stock which would give control.

### Yavapai County

UNITED VERDE EXTENSION (Jerome)—Contract for about 20,000 cu.yd. of concrete for the new smeltery will shortly be let.

JEROME-VICTOR EXTENSION (Jerome)—Some of the new equipment, including 150-hp. hoist, air compressor, boilers, cars, cage, pumps, etc., is arriving.

### Yuma County

ARIZONA REVENUE COPPER (Parker)—On Echo group, near western end of property, opened 3% orebody, from which preparing to ship some selected ore. H. A. Morse, superintendent.

## CALIFORNIA

### Amador County

KEYSTONE (Sutter Creek)—New station cut on 1800 level; crosscutting in progress. Forty stamps dropping on ore from 900, 1000, 1200 and 1400 levels.

SOUTH KEYSTONE (Amador)—Water lowered to 600 level. Next level is at 1000-ft. point near bottom of shaft. Complete unwatering and repair of shaft is contemplated.

KENNEDY (Jackson)—Shaft has reached the 4000-ft. point and preparations being made for new station. Recent report that company was reopening Zeila mine is untrue; survey made, but no step yet taken toward operating the mine.

CENTRAL EUREKA (Sutter Creek)—Thirty stamps dropping on ore from 2800- to 3200-ft. levels. Good ore also being developed in the 2500 crosscut where vein was disclosed recently. Shaft being deepened at rate of 15 ft. a week.

HARDENBERG (Jackson)—Unwatering and repairing shaft completed and levels are being put in working condition. Shaft is 1100 ft. deep; two levels were cut in former operation, one at 850 ft. and one at 1000 ft. and ore disclosed by crosscut. W. J. Loring is operating under purchase option.

### Butte County

BUTTERFLY (Oroville)—Recent development disclosed pay gravel in what is believed to be a large channel. Operated under option by W. T. Baldwin and associates.

ST. FRANCIS (Oroville)—Gold property in the eastern part of the county near Kanaka Peak, reported to have been purchased by Engels brothers who are principal owners of the Engels copper mine in Plumas County.

### Calaveras County

ANTIMONY ORE in vicinity of Mokelumne Hill reported by Lyden and Hoerchner who have known of the deposit for several years, but were unaware of its character and value. Presence of stibnite, associated with gold ores at Mokelumne Hill has been reported by the State Mining Bureau, "Bull. 67," and known also along the Mother Lode, but no production or commercial development in this region has ever been officially reported.

### Inyo County

ANTIMONY ORE near Bishop, recently reported by J. G. Bryan, is being prospected and sampled. Inyo County has long been known to contain antimony ores, although this is the first reported discovery in the Bishop district; Wild Rose mine in southern part of county was largest individual producer of antimony ore in 1915. There were 5 producers in Kern County and one each in Inyo and San Bernardino. Numerous veins of stibnite have been reported in other southern counties, chiefly associated with cinnabar.

### Nevada County

DELHI (Nevada City)—Reported that operations are temporarily suspended owing to water supply being cut off by freezing.

LE DUC GOLD MINING CO. (Grass Valley)—Owners, after 10-year operation as individuals, have incorporated with the following officers: Charles H. White, president; B. A. Penhall, vice-president; James Sampson, secretary; Nevada County Bank, treasurer. Capital stock $500,000, of which ⅔ is preferred. Company owns mineral rights on ground, adjoining the Empire on the east, and will develop by shaft and tunnels.

### Siskiyou County

COPPER DEPOSIT on north fork of Little Humbug Creek is reported by Harry Daggett who mines and farms on McKinney Creek, north of Yreka. This region has not been prospected for copper, but there is copper north and northwest. It is said the property will be explored for San Francisco men.

GRAY EAGLE (Happy Camp)—Preparation for development and the installation of machinery progressing as rapidly as conditions permit. Diamond drill men are ready, waiting for drills to arrive. Delivery of 2000 cords of wood will begin as soon as the compressor is installed. Heavy snow and bad roads have retarded work.

### Trinity County

HYDRAULIC MINING resumed at the Lorenz and the Testy mines on Feb. 14. La Grange will resume as soon as the siphon on Stewarts Fork is repaired.

### Tuolumne County

SHORE (Jamestown)—New prospecting mill installed on Table Mountain for crushing ore already extracted. Joseph Shore, owner.

SPRINGFIELD TUNNEL (Columbia)—Keystone drills on Barry channel making fine progress, showing 40 ft. of gravel. Tunnel will be advanced to the vicinity of the old workings near Springfield.

STARR KING (Tuolumne)—Permit by State Water Commission to divert 4 miners' inches from springs for mining purposes. Pipe line 1800 ft. long will be installed. Ronald C. Kennedy, owner.

HEAD CENTER (Sonora)—R. R. Daves recently sold one-half interest to W. J. Temple of San Jose. Will install hoist and milling plant and the 35-ft. shaft will be deepened, with station and drift at 100-ft. point. The 5-stamp mill formerly on Basin Slope mine and boilers and steam hoist equipment have been purchased for this property.

## COLORADO

### Chaffee County

INDEPENDENCE (Turret)—R. F. Stratton has cut on 120-ft. level high-grade zinc-copper ore. Incline is being straightened and new equipment is to be installed.

MOLLY GIBSON LEASING CO. (Turret)—The old shaft unwatered; developing on 100-ft. level where sylvanite was cut in the north drift; in the east drift shipping ore is being mined and sorted.

TURRET COPPER MINING AND REDUCTION (Turret)—Will begin shipping soon from the M. & W. 150- and 200-ft. levels. Main shaft extended and a crosscut on the 200-ft. level, 125 ft. to the west, has cut several low-grade veins.

### Custer County

BISMUTH (Westcliffe)—Iron-silver ore from above water-level being shipped by lessees.

LADY FRANKLIN (Westcliffe)—Lessees on this White Hills property sinking new shaft and mining lead-carbonate ore.

BELLE (Westcliffe)—Lease taken and shaft sinking begun; adjoins famous old Bull-Domingo mine on west.

### Clear Creek County

OTTAWA GROUP in the Alice district was recently sold to Silverton and Denver men. Over 2000 ft. of development work done and considerable good-grade gold ore opened. New crosscut tunnel to be driven.

SUN AND MOON (Idaho Springs)—Work resumed under Superintendent C. J. Hershey.

WESTERN TUNNEL MINING CO. (Idaho Springs)—New incorporation to develop Vindicator group of 34 claims.

DUMONT MINING AND MILLING CO. (Dumont)—New incorporation to acquire the Syndicate property and the Pioneer mill at Dumont, and property of the Pioneer Gold Mining Co. at Empire. Will remodel Pioneer mill. Officers are: George Wright, president; Ernest Wright, vice-president; Simon Bitterman, treasurer; and C. W. Lerchen, secretary and manager. Head office in Denver.

### Lake County

MONARCH (Leadville)—Shaft being sunk another 100 ft.

ROBERT EMMETT (Leadville)—New electrical machinery being installed at shaft by Empire Zinc Co., now operating this mine.

### Ouray County

VERNON (Ironton)—Three Leyner drills and new hoist, with capacity of 3000 lb. from 1000-ft. depth, installed. Sinking of shaft to 500-ft. level to be started after further exploration of oreshoots opened on 300 level.

### San Juan County

HAMLET (Silverton)—Developing. Mill being remodeled for spring campaign of production.

COMING WONDER (Silverton)—Lessees working this mine on Anvil Mountain. Silver-lead-zinc ore being packed to railroad for shipment.

SILVER LAKE (Silverton)—Leasing firm of Slattery, Delsant & Gillett making regular shipments.

GREEN MOUNTAIN (Silverton)—Development will continue at this Cunningham gulch property during winter. In spring active operations will be resumed under management of L. R. Clapp for the American Smelting and Refining Co.

### San Miguel County

ACTIVITY IN OPHIR DISTRICT at this time of year indicates extensive work next spring and summer. Silver Bell mine being developed at Ophir Loop by Ophir Loop Mines Co.; Ophir Mining Co. is operating Suffolk mine; Highland Mary, Carbonero, Badger Tunnel and several smaller properties also active.

MOUNTAIN FLOWER (Telluride)—Development in progress in this property on Deep Creek.

CARRUTHERS LEASE (Telluride)—Inema & Perino, lessees on this part of Smuggler-Union ground, shipping two cars concentrate per month.

### Summit County

JANUARY SHIPMENTS of ore and concentrates from Breckenridge amounted to 175 cars or about 4725 tons.

JUNE BUG (Breckenridge)—Lessees on this Gibson Hill property have struck high-grade gold-silver ore.

JOHANNESBURG (Breckenridge) — This old mine in French Gulch has been leased; equipment includes milling plant.

GOLDEN QUEEN (Kokomo)—Vein, 8 ft. wide and asaying well in silver, lead and zinc, discovered recently in opening old lower-tunnel workings. Some of ore shows much free silver. Discovery first made in surface workings, then in 45-ft. shaft. Mutual Coöperative Mining Co. then organized, and lower Gold Queen tunnel advanced to vein, cutting it at considerable depth. Much excitement caused by strike, and other old properties being opened.

### Teller County

SIX POINTS (Cripple Creek)—Lessees McLeod and Kessee are shipping payable ore from development.

GOLD BOND (Victor)—Development has opened payable ore at several points near Hummer shaft. Water line is being laid from El Paso company's pipe line. Machine drills will be installed. F. L. Wilcox, manager.

MARY McKINNEY (Anaconda)—Marketed last year 6328 tons of ore of gross value of $131,265; cash on hand Dec. 31, 1916, was $82,806. Directors appropriated $20,000 for explorations on ninth and tenth levels, recommended by engineers.

CRIPPLE CREEK DEEP DRAINAGE AND TUNNEL CO. (Cripple Creek)—Mineralized phonolite dike, 30 ft. wide, cut in Roosevelt tunnel at depth of 1700 ft. under Phœnix fraction belonging to Ramona Gold Mining Co., a close corporation controlled by Colorado Springs and Cleveland men.

PORTLAND (Victor)—Production in 1916—excluding Independence mine—amounted to 418,937 tons valued at over $3.040,000 or about $7.50 per ton; net profit $768,810; dividends paid 14c. per share or $420,000; total to date $10,597,080. There are 58 mi. of underground workings in the Portland mine. Independence 350-ton mill will be quadrupled, employing flotation for the sulphide ores; oxidized ore will continue to be cyanided. Dump ore treated last year averaged $2.64 per ton.

## GEORGIA

### Lumkin County

CROWN MOUNTAIN MINING AND POWER (Dahlonega)—A. H. Head, metallurgical engineer, who has been testing Crown ore in the small mill for some months, reports a recovery of 84%; 30% was obtained by amalgamation and 54% by cyanidation. Plans prepared for 100-ton cyanide plant; ore expected to average $6. W. D. McGinnis, general manager.

## IDAHO

### Bonner County

HOPE MINING AND MILLING (Sandpoint)—Two copper-sulphide veins cut in 313-ft. tunnel; last one drifted on for 50 ft. W. P. Shutz, interested.

### Custer County

COPPER BASIN MINING (Mackay)—Shipping about 250 tons per week, carrying 7 to 12% Cu, 5 to 6 oz. Ag and about $1 in gold. To avoid 23-mi. wagon haul, contemplate erecting 200-ton leaching plant; process being developed by Merrill Metallurgical Co., of San Francisco. Fred H. Vahrenkamp, of 911 Boston Building, Salt Lake City, Utah, general manager.

### Idaho County

OROGRANDE GOLD MINING (Orogrande)—Litigation settled and as soon as weather conditions permit, mill equipment will be brought in. A 150-ton countercurrent decantation plant ordered, including two 5x22-ft. Power and Mining Machinery tube mills, with El Oro lining; 2 Dorr standard duplex classifiers; machinery for 4 Dorr agitators in tanks 22x22x10 ft.; 12 Dorr thickeners for tanks, 22x22x6½ ft. (rectangular steel tanks previously used by old company as sand tanks); 9 Dorr 4-in. diaphragm pumps; 300-cu.ft. Laidlaw low-pressure air compressor for cyanide plant. New power equipment will include 1200 ft. 13-in. steel penstock pipe; 6-ft. Pelton wheel, 300 hp., to drive tube mills and 20 stamps; 70-in. Pelton wheel for compressor, elevator and classifiers; 60-in. wheel to drive cyaniding machinery and pumps; 42-in. wheel for No. 5-D Gates crusher. The ore, which has been estimated to average $3.20 per ton, crushes easily and may be cheaply mined; glory-hole method formerly used but steam shovel may be installed and entire dike, about 400 ft. wide, mined. F. W. Bewley, manager.

SOUTH LAKE (Houghton)—Tonnage increased to 164 tons daily, yielding about 17 lb. per ton.

### Owyhee County

FEDERAL MINING AND SMELTING (Hailey)—Snowslide on Feb. 25 struck North Star compressor house, warehouse and bunk house, killing 15 men. Thomas Jay, mine superintendent, among the injured.

## MICHIGAN

### Copper

COPPER RANGE (Painesdale)—Sinking in Champion No. 3 shaft.

KEWEENAW (Mandan)—Still short of men but running mill 18 hr. per day.

ISLE ROYALE (Houghton)—Damage done by water not so great as expected, but daily production curtailed about 300 tons.

NEW BALTIC (Baltic)—Down 50 ft. with shaft on New Arcadian lode. Rock of good character and it is believed will pay expenses of sinking.

FRANKLIN (Demmon)—With installation of mechanical haulage on three levels, getting 50% more rock with about one-half the number of trammers.

NORTH LAKE (Lake Mine)—Levels in the new lode showing good mineralization. One drill transferred to crosscut to get necessary geological data for correlation of lode.

AHMEEK (Ahmeek)—Has been drifting on Kearsarge conglomerate lode for about a month. Eighth head at stamp mill at Hubbell is being supplemented with rolls to increase capacity of the unit.

NEW ARCADIAN (Houghton)—Both drifts for length of about 40 ft., have good-grade ore on foot-wall side, but almost entire width of 24 ft. can be mined. Lack of men caused closing of No. 2 Shaft. When new rockhouse engine is installed, mill test will be made, probably at the Franklin mill. Developing on the 900- 1200- and 1500-ft. levels.

### Iron

IN QUINNESEC DISTRICT, several drill holes on the McKenna homestead show low-grade but merchantable ore. Mine may be opened. At present not a single mine is operating in district.

AURORA (Ironwood)—Shaft now full size down to depth of 1200 ft. Sinking discontinued; raising started from 19th level; connection will be made at 17th level. Shaft, inclined at 68°, will be lined with concrete and steel.

WEST CHAPIN MINES CO. (Iron Mountain)—Organized to develop lands west of Chapin mine of Oliver Iron Mining Co. Shaft several hundred feet deep; additional work to be done. Large body of low-grade ore known to exist. Ore low in phosphorus. May be mined with steam shovels.

## MINNESOTA

### Cuyuna Range

ROWE (Riverton)—Contract let to E. J. Longyear Co. for sinking 12x18-ft. shaft to rock or to depth of not less than 250 ft.

C. M. HILL LUMBER CO. (Ironton)—This company has four diamond drills working on S½, SW¼, Sec. 2, 46-29, recently leased from Cuyuna Realty Co. Previous drilling indicates openpit mining.

JOAN (Ironton)—Shaft is through overburden and is 25 ft. in rock. Sublevel will be developed at 75 ft. and the main level at 125 ft. Drill explorations indicated large body of manganiferous ore. Company will enter shipping list this coming season. Operation financed by Marcus L. Fay. C. M. Pierce is superintendent.

### Mesabi Range

BENNETT MINING CO. (Nashwauk)—New company organized to operate Longyear-Bennett mine. Men connected with Pickands, Mather & Co., Pittsburg Steel Ore Co., and Youngstown Sheet and Tube Co on board of directors. Mine already a producer; opened two years ago.

TENER (Chisholm)—Work of concreting shaft completed; now 7 by 18 ft. inside. Shaft used four years; exact counterpart now of Monroe shaft.

MAJORICA (Calumet)—New mine of Hobart Mining Co.. Equipment on ground for stripping. About 400,000 cu.yd. will be removed. Over 1,000,000 tons of ore proved by drills. Close to Hill Annex pit. Some ore will be shipped this year. Pickands, Mather & Co. will act as sales agents.

## MISSOURI

### Joplin District

TIGER (Tar River, Okla.)—Let contract for 350-ton mill on lease north of Walker Mining Co.

BLUE MOUND (Baxter, Kan.)—New mill produced 337 tons of concentrates first eight days of operation.

TEXAS (Joplin)—Installing crusher and rolls at mine; mill burned two years ago. Recent work developed galena and blende run.

LOGAN BROS. & HOLT (Tar River, Okla.)—Sunk shaft on lease near Montreal mine, in Century camp, and made rich strike.

THOMAS F. COYNE (Webb City)—Will build new mill at old Victor mine on Connor land. Ore showed 7% blende at custom mill.

MISSOURI (Joplin)—Starting shaft at mill on Thoms Station property. Ore to date taken from field shaft, east of mill. Later second field shaft will be sunk.

ADAMS-HICKS (Joplin)—Using "string pump" method of draining tract 4 mi. southeast of Joplin. By use of steel cable strung on poles, several walking-beam pumps operated by one gas engine.

RED FOX (Baxter, Kan.)—Sinking shaft and preparing to erect 300-ton mill on lease, northeast of Picher, Okla., just south of Kansas-Oklahoma state line. H. C. Austin, principal owner.

I. L. BURCH, until recently assistant state mine inspector has obtained, with associates, leases on 3000 acres northeast of Waco, Mo., and will prospect with drills. District is in line of extension of Commerce, Okla., field to Lawton, Kan. Recent finds near Waco causing activity there.

## MONTANA

### Cascade County

BUTTE & GREAT FALLS MINING (Neihart)—Since cessation of operations at company's Butte properties, development at its properties in the Neihart district has reached a point where regular shipments of three cars a week to Anaconda will be made, pending installation of air compressor when output will be raised to 50 tons a day. Ore runs high in lead, silver and zinc. A shipment of 17 tons from the adjoining Belt mine netted $10,000.

### Lincoln County

TOGO (Troy)—Making extensive improvements at its property in the Eureka district and will develop 500 hp. for hydroelectric plant. New 10-drill compressor and other equipment being installed.

### Silver Bow County

DAVIS-DALY (Butte)—Ore returns for quarter ended Dec. 31 were $146,822; expenditures, $142,595. Development consisted of 534 ft. of drifts and 647 ft. of crosscuts.

NORTH BUTTE (Butte)—January output amounted to 2,744,103 lb. copper, 124,362 oz. silver and 196 oz. gold. Extensive new development work under way, about 600 ft. of crosscutting being done per week in the new orebodies. Zinc production increasing.

BUTTE & LONDON (Butte) — Unconfirmed rumors are passed around that property is to be taken over by a new company. Meantime machinery is being dismantled and sold. North Butte has bought compressor and Butte & Zenith City company has bought electric pump. Other companies are looking over machinery with idea of buying whatever can be utilized.

BUTTE-NEW YORK MINING (Butte)—Operations resumed at company's properties which adjoin Butte & Superior mines and are controlled by latter company under contract to develop. Drifting on Colonel Sellers vein which promises to develop into a valuable body of zinc ore. This will enable Butte & Superior to increase present output or at least maintain it, should injunction asked for by Elm Orlu company be granted, thereby preventing Butte & Superior from mining in disputed ground.

TUOLUMNE (Butte)—Development on 700 level of Sinbad claim in company's Butte Main Range property shows orebody to be one of great extent and unusual richness. Recently in the west crosscut 8 ft. of the Spread Delight vein showed 63 oz. silver and 3½% copper. Ore taken out in course of development work returns $550 per day, covering practically all the expenses of development work. Large compressor ordered and new hoist and other equipment will probably be installed at Main Range the coming summer. At company's old property on Anaconda hill, 1600 tons of ore were mined and shipped, during first half of February. January shipments from both Tuolumne and Main Range properties returned $35,000.

## NEVADA

### Lincoln County

AMALGAMATED PIOCHE (Pioche)—Stoping discontinued because of unsatisfactory smelting contract, zinc smelters having a surfeit of ore. Development will be continued in search for old Raymond & Ely lead-silver vein under direction of Theodore F. Van Wagenen. Superintendent H. R. Van Wagenen will be absent about five months on a South American examination.

### Lyon County

MASON VALLEY MINES CO. (Thompson)—Smelting resumed with one furnace on Feb. 13 with Mason Valley and Bluestone ore; other custom ore will be received later, and it is hoped that a sufficient coke supply will be accumulated to permit the blowing in of the second furnace by the middle of March.

### Mineral County

HIGH GRADE COPPER MINING AND LEASING (Mina)—This company has taken over the property, 9 mi. east of Mina, owned by Messrs. Messinger, Hansen, Hood and Reddish. Ore occurs at limestone-granite contact and besides copper carries gold and silver. Leasers still working in property. Last shipment averaged 18.9% Cu; another now ready. C. E. Noble, secretary.

JUMBO EXTENSION (Rand)—At Copper Mountain property, recently optioned, development shaft down 75 ft., being sunk with two shifts. Leasers continuing to work, three sets shipping regularly from Nolan, on Hazen-Mina branch of Southern Pacific. If company developments are satisfactory, will install 25-hp. hoist, air compressor, drills and 6-ton truck. J. K. Turner, of Goldfield, consulting engineer.

### Storey County

ANDES (Virginia)—Saved 75 cars averaging $9.40 per ton from 350 level stope.

COMSTOCK PUMPING ASSOCIATION (Virginia)—Water in shaft now below 2900 level.

UNION CON. (Virginia)—Extracted 44 cars from No. 10 stope, 2500 level, sampling $27.39; 40 tons from No. 11 stope, $15.05 per ton. South drift on 2600 level extended 18 ft., and extraction from roof of drift 6 tons of ore, averaging $67. Face shows 3 ft. of quartz, sampling $13 to $62.

### White Pine County

SALT LAKE-TUNGSTONIA MINES CO. (Aurum)—Mill at Tungstonia handling 20 tons per day; test of concentrates showed 71% $WO_3$. Shipments must await improved weather conditions owing to 50-mi. haul to railroad. Developments in mine favorable and funds being set aside for enlargement of mill to at least 50 tons capacity. L. W. Robbins, general manager. Head office, 212 Kearns Building, Salt Lake City, Utah.

## NEW MEXICO

### Grant County

AUSTIN-AMAZON COPPER (Silver City)—This property, about 6 mi from Tyrone, shipping four to five cars per week from orebody now opened for length of 100 ft. Power hoist just installed and will sink development shaft to 500 ft. with levels at each 100 ft. Air compressor and 60-hp. engine, wtih drills, expected to enable company to get out about 100 tons daily. W. W. Porterfield, vice-president.

## UTAH

### Beaver County

RED WARRIOR (Milford)—Ore being mined from old stopes. Development being done on 200 and 500 levels. Power furnished by Moscow compressor. G. S. Wilkin, superintendent of the Moscow, in charge of operations.

### Box Elder County

LAKEVIEW MINING (Promontory Point)—January shipments amounted to four cars zinc and one car lead ore. Four cars—one lead, three zinc—ready for shipment; production by lessees, of which 24 are working.

### Juab County

TINTIC SHIPMENTS for week ended Feb. 16, amounted to 235 cars, a record week among recent shipments.

EUREKA HILL (Eureka)—This close corporation, having 10,000 shares, paid dividend of $1 a share or $10,000 in 1916; production during 1916 was 46 cars.

PROPERTIES IN WEST TINTIC or Erickson district that are now operating include: Happy Jack, Deseret Mines, Pyramid Summit, Mammoth Queen, etc. Ore chiefly lead-silver.

EMPIRE MINES (Eureka)—Company being organized to take over Lower Mammoth, Boston & Tintic, Central Mammoth, Tennessee, Rebel, Old Colony & Eureka, Black Jack, Garnet, Opex, and Manhattan—all controlled by Knight interests—having combined territory of 600 acres. Stockholders' meetings to approve merger to be held middle of March.

### Salt Lake County

MONTANA-BINGHAM (Bingham)—Capitalization increased from $1,500,000 to $3,000,000. Increase to be placed in treasury with a view to financing operations. Company owns 170 acres and a fifth interest in adjoining Bingham Amalgamated's 300 acres. There is a tunnel 4785 ft. in length, and other workings. Ore is heavy sulphide, largely pyrite carrying a little chalcopyrite, and in places a small amount of secondary chalcocite. Shipments made by lessees have run from 2 to 4% or more in copper.

### Summit County

PARK CITY SHIPMENTS for the week ended Feb. 16, amounted to 1550 tons of ore and concentrates.

JUDGE MINING AND SMELTING (Park City)—Try-out of new zinc plant reported successful.

DALY (Park City)—Conditions more encouraging. Shipped 107,900 lb. of ore week ended Feb. 16.

COMSTOCK-CALIFORNIA (Park City)—Two adjoining properties—19 claims in all—contiguous to Silver King Coalition and Crescent, consolidated under above name. Capitalization, 1,000,000 shares, par value $1, with 615,000 shares in treasury. Ore left exposed—on suspension of operations several years ago, owing to apex litigation—on 450- and 250-ft. levels, which together have produced about 7000 tons of shipping ore. Five feet of ore also exposed in Comstock tunnel. Lessees working on upper levels, week ended Feb. 16, shipped about 33 tons of ore. Property has hoist, compressor, etc., and mill. Work on company account starting promptly.

### Utah County

BELEROPHON (American Fork)—Work resumed in north drift from main tunnel, where streak of rich ore carrying silver opened.

MILLER HILL (American Fork)—Gas encountered in company's tunnel determined to be carbon dioxide, and thought to come from oxidation of sulphide ores, the resultant sulphuric acid acting on the limestone. Fan and double motor installed. Work resumed.

## WYOMING

PORTLAND CONSOLIDATED COPPER (Encampment)—Shaft unwatered and sunk to 285 ft. Spur vein, encountered in shaft, drifted on, and ore from it and from main vein being sacked for shipment when railroad service is resumed. Guy S. Weston, manager.

## CANADA

### Ontario

CONIAGAS (Cobalt)—The 150-ton flotation plant now running smoothly. New 2-in. low-grade vein cut at 150-ft. level.

MILLER LAKE (Gowganda)—Reported that the silver ore in sight on new deep level is extensive and rich. It is being prospected as rapidly as possible.

SHAMROCK (Cobalt)—Encouraged by success of the Beaver, the management is planning to sink to 1600 ft. and explore lower contact as soon as funds can be raised.

VIPOND-NORTH THOMPSON (Porcupine)—Three-compartment shaft down to 600-ft. level; station cut, and 900-ft. connection will be driven to Vipond workings. Large compressor ordered.

BELLE ELLEN (South Lorain)—Shaft, down 250 ft., will be continued another 100 ft. before lateral work. Contact between diabase and Keewatin is expected to be reached at depth of 325 ft.

KENABEEK (Auld Township)—Silver ore reported at 104-ft. level, but it is thought to be only a small pocket. Shareholders, on Feb. 22, decided to purchase the Hitchcock mine and increase capital to $2,000,000.

HOLLINGER CONSOLIDATED (Timmins)—First annual statement shows production of $5,073,401, as against an output of $4,205,901 by the old Hollinger company in 1915. Dividends paid were $3,126,000 as against $1,720,000. Profits from operations amounted to $2,866,984 and income from premium on shares sold to $180,000. Deducting $40,575 for taxes and $150,000 written off for depreciation the net income was $2,856,409, leaving a deficit after the payment of dividends of $269,590. Whether present rate of dividend with less frequent distributions, or whether the rate will be reduced by one-half will be announced at the annual meeting. Managing Director P. A. Robbins estimates ore reserves at end of the year at 3,938,000 tons of an average value of $8.68 per ton or $34,185,535 as compared with $33,837,870 on Dec. 31, 1915. Total cost in 1916 amounted to $2,428,601, or $4.03 per ton, as compared with $3.98 in 1915. Additions to plant and equipment totaled $599,417 and the total development accomplished was 20,280 ft.

## MEXICO

AMERICAN SMELTING AND REFINING (Monterey, Nuevo Leon)—Three lead furnaces blown in on Feb. 19, resuming smelting operations discontinued in March, 1916, when, after about eight weeks' operation at Monterey and Matehuala, smelting was suspended owing to general hostility toward all American enterprises. Two copper furnaces at Monterey will soon be started, and as soon as typhus can be stamped out the copper furnaces of the Matehuala plant will blow in.

## CHILE

SALE OF NITRATE AREAS announced for Apr. 16. Details may be obtained from the Chargé d'Affaires of Chile, Washington, D. C.

# The Market Report

## Metal Markets

SILVER AND STERLING EXCHANGE

| Feb. | Sterling Exchange | Silver New York, Cents | Silver London, Pence | Feb. | Sterling, Exchange | Silver New York, Cents | Silver London, Pence |
|---|---|---|---|---|---|---|---|
| 22 | ..... | ... | 37 9/16 | 26 | 4.7538 | 77⅛ | 37⅛ |
| 23 | 4.7538 | 77⅛ | 37⅛ | 27 | 4.7538 | 77 | 37⅛ |
| 24 | 4.7538 | 77⅛ | 37⅛ | 28 | 4.7538 | 77 | 37⅛ |

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

| Feb. | Copper Electrolytic | Tin Spot. | Lead N. Y. | Lead St. L. | Zinc St. L. |
|---|---|---|---|---|---|
| 22 | ..... | .. | ... | ... | ... |
| | 31½ | | 8½ | 8½ | 10 |
| 23 | @33½ | 49 | @9½ | @9¼ | @10½ |
| | 31½ | | 8½ | 8½ | 10 |
| 24 | @33½ | 49½ | @9½ | @9¼ | @10½ |
| | 31½ | | 8½ | 8½ | 9¾ |
| 26 | @33½ | 50 | @9½ | @9¼ | @10 |
| | 31½ | | 8½ | 8½ | 9¾ |
| 27 | @33½ | 50¾ | @9½ | @9¼ | @10 |
| | 31½ | | 8½ | 8½ | 9¾ |
| 28 | @33½ | 51 | @9½ | @9¼ | @10 |

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies; and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold on "regular terms" (r.t.), including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

| Feb. | Copper Standard Spot | Copper Standard 3 Mos. | Copper Electrolytic | Tin Spot | Tin 3 Mos. | Lead Spot | Zinc Spot |
|---|---|---|---|---|---|---|---|
| 22 | ..... | ..... | 150 | ..... | ..... | ..... | ..... |
| 23 | 139 | 136½ | 150 | 197¼ | 197½ | 30.5 | 47 |
| 24 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 26 | 139 | 136½ | 151 | 198½ | 198½ | 30.5 | 47 |
| 27 | 139 | 136½ | 151 | 201 | 201 | 30.5 | 47 |
| 28 | 139 | 136½ | 151 | 202¼ | 202¼ | 30.5 | 47 |

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 643c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜c.

**NEW YORK—Feb. 28**

In copper and lead there was an increased volume of transactions during the last week. Spelter continued dull, although a fair tonnage was reported sold. Tin was very sensitive and moved upward.

## Copper, Tin, Lead and Zinc

**Copper**—The copper market became more interesting last week, especially in the development of a larger volume of business for third-quarter delivery, while some sales—one of them rather large—were made for delivery during the second-half of the year. The latter business was taken at considerably below what is considered to be the major market at the present time. Another interesting feature was the practical disappearance of all copper for delivery this side of June. Some June copper appears to be still available, but is kept as a sweetener for July delivery. The price for June-July copper was about 33½c., which is the top of the market, although carload business in prompt delivery may be done at prices of 37c., or even upward. Business for July delivery was done at 31¾@32¼c., some round lots being sold at those figures on Feb. 26, while business for August delivery on the same day was done at half a cent less.

**Copper Sheets**—Some manufacturers have raised the base price of sheets from 42c. to 44c. per lb., but the change has not been universal. We quote hot rolled 42@44c., cold rolled 1c. higher. Wire still remains at the former figure of 37c. f.o.b. mill.

**Tin**—But very little business was done. Throughout the week the market was irregular and hard to gage. It was very sensitive and fluctuated under small influences.

**Lead**—Much confusion continued to prevail in this market. Reports were quite conflicting. From some quarters it was reported that inquiry was less than in the previous week. This might be explained by customers refraining from making inquiries in quarters whence they could not be supplied. In general, producers reported a larger inquiry from consumers, which extended to April delivery and even to May-June. And certainly a larger volume of transactions was reported to us than in the previous week. The A. S. & R. Co. maintained its price at 8½c. Other producers realized as high as 9½c. The bulk of the transactions of which we had reports were done at about 9c.

The freight situation appeared to show a little improvement. It was reported that some bonded lead was sold in the New York market. At present prices such lead could be easily entered for domestic consumption with payment of the duty. Some smelting furnaces in Mexico have been put in operation and it is expected that new lead from that source will become available in this market in the latter part of March. Japan inquired for lead in this country this week and apparently was willing to pay high prices.

**Zinc**—A fair volume of business was done during the week. To a considerable extent this was with dealers, some producers who accepted such business, reporting no inquiry from consumers. The market eased off a little during the week. On Feb. 26, a round lot for delivery in the first half of March was sold at 10c., while on Feb. 27 a considerable tonnage for April-June delivery was done at 9¾c.

**Zinc Sheets**—No change has been made in the market price of zinc sheets. Quotation is $21 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

## Other Metals

**Antimony**—Market dull, but strong due to freight embargoes which have tied up metal from the far East being shipped across the country by rail. We quote spot 31@32c. March-April shipments from China quoted at 15@15½c. c.i.f., New York, duty unpaid; market dull and rather unsettled.

**Aluminum**—The aluminum market is still quiet. Some sales are said to have been made at 59c. and some slightly higher. We quote the same as last week, 58@60c. per lb. for No. 1 ingots, New York.

**Nickel**—The nickel quotation has not been changed. The market is steady, with price at 45@50c. per lb., electrolytic commanding an additional 5c. per lb.

**Quicksilver**—Market fairly steady after having gradually sagged down to $125, which price we quote. Deliveries have been large but new sales have been small. In order to take advantage of high prices, some small lots are arriving by express as freight embargoes have tied up ordinary shipments. San Francisco reports by telegraph, $125 weak.

## Gold, Silver and Platinum

**Gold**—A report from Samuel Montagu & Co., London, under date of Feb. 1, 1917, states that the Rhodesian gold output for December, 1916, amounted to £306,205, as compared with £301,376 in December, 1915, and £317,135 in November, 1916. The total output for 1916 amounted to £3,895,311, as compared with £3,823,166 in 1915.

The West African gold output for December, 1916, amounted to £146,409, as compared with £158,323 in December, 1915, and £130,101 in November, 1916. The total output for 1916 amounted to £1,615,306, as compared with £1,706,473 in 1915.

Gold to amount of $28,500,000 has arrived from Canada consigned to J. P. Morgan & Co. This shipment brings total gold imports from all sources this year up to $130,000,000, and total imports since Jan. 1, 1915, are $1,267,500,000.

New York Federal Reserve Bank has purchased from J. P. Morgan & Co. approximately $12,000,000 of the $28,500,000 gold which arrived from Canada. Although the gold consists of foreign bars, some of which are nine-tenths fine and others eleven-twelfths fine, it will be stored in vaults of the bank at least for the time being and will be counted as a part of its reserve, since federal reserve act does not require that gold reserve of federal banks be American gold coin or bars.

**Silver**—Market has been very steady the past week. No movements of any importance have taken place in the silver situation. Coinage occupies the chief place of interest in the various countries, associated with the Allies. It is understood that Japan is a prominent factor in furnishing coins to Russia, probably from silver supplies imported from China. To what extent this is going on, the figures are not available to indicate.

Samuel Montagu & Co., London, report, under date of Feb. 1, that the Joint Stock banks are now finding stocks of silver coin somewhat redundant. This seems to indicate that demands for the home country are likely to be less in evidence, but the home demand has for some time past been very insignficant in comparison with that for India and the Allies. The strength of the China exchange is, of course, against sales for that quarter. The stock in London last Friday was found only to be about 4,000,000 fine oz., a reduction of 2,400,000 in one month.

In changing the location of the silver averages for 1916, first appearing in the "Journal" of Feb. 3, a typographical error occurred, changing the December, 1916, average from 75.765, the correct figure, to 75.265c.

Mexican dollars at New York, Feb. 23, 60@63c.; 24, 60@63c.; 26, 59¾@62¾c.; 27, 59½@62½c.; 28, 59⅜@62⅜c.

**Platinum**—This market was a little more irregular, and certainly easier. Sales were reported at $102.50. We quote $100@105.

**Palladium**—Quoted at $85.

## Zinc and Lead Ore Markets

**Platteville, Wis., Feb. 24.**—Blende, basis 60% Zn, $90 for premium ore down to $85 for medium grade. Lead ore, basis 80% Pb, $110 per ton. Shipments for the week are 3208 tons of zinc ore, 30 tons of lead ore and 243 tons of sulphur ore. For the year to date the figures are: 20,970 tons of zinc ore, 508 tons of lead ore and 3432 tons of sulphur ore. Shipped during the week to separating plants, 3600 tons of zinc ore.

**Joplin, Mo., Feb. 24**—Blende, per ton, high $101.95. Basis 60% Zn, premium $90, medium to low, $90@80. Calamine, 40% zinc, $55@50. Average selling price, all grades of zinc, $83.

Lead, per ton, high $126.80. Basis, 80% Pb, $124@110. Average selling price, all grades of lead, $112.74.

Shipments the week: Blende 8510, calamine 1185, lead 1781 tons. Value all ores the week, $1,005,370.

Shipment two months: Blende 62,298, calamine 4809, lead 11,322 tons. Value, all ores two months $6,409,760.

In the face of the freight embargo purchasing agents for the zinc-smelting companies are buying unusually large quantities of ore. It is estimated that 50% of the 12,000 tons stock in bins is now owned by smelting companies. Failure to secure importations of ore, and several companies being shut out of the West is sending buyers here for a much greater tonnage. Promises are made by the hydroelectric company that some additional power will be supplied in another week.

## Other Ores

**Antimony Ore**—This ore is now offered from South America for the first time since the fall in price in 1916. Ore for March shipment is quoted at $2.30 per unit.

**Molybdenum Ore**—Charles Hardy, in his report under date of Feb. 27, says the following: "There is no change in the actual position of molybdenum. However, efforts are being made by some reliable parties who own properties in the West to develop their property, but un-

fortunately, such development will not bring any molybdenite on the market before two or three months."

**Tungsten Ore**—We quote this market at $16.50 @17 per unit.

Charles Hardy, in his report under date of Feb. 27, gives the following interesting information: "The past week has been just as interesting, if not more, than the previous week in the tungsten market. The shortage of spot tungsten, especially scheelite, becomes more accentuated and prices advanced further until during the last days of the week $18 was paid for prompt material. Some of the tungsten consumers in this country have allowed themselves to run so short of stocks that material was bought in New York by the carload and rushed to the steel districts by express. In addition to the demand from our own buyers, the foreign demand continued unabated and the tungsten ore handled during the last eight days ran into many hundred tons. Wolframite on the spot in New York, which was sold down to $16, recovered and $16.50@17 was paid. At the moment of writing, a further contract for 100 tons tungsten from abroad is under negotiation and the elimination of this quantity will reduce the present New York stocks to a negligible quantity. One of the European countries is in the market for 50 tons of ferrotungsten and this inquiry is a further help towards strengthening the market. The large producers in the West have tungsten ore ready for shipment but are unable to move it on account of the railroad embargo."

## Iron Trade Review

### NEW YORK—Feb. 28

Pig iron continues to hold the spot light, according to "Iron Age." The spurt which the car congestion gave to prompt delivery buying two and three weeks ago was accentuated in the past week by still higher and more widely divergent prices. Dependent largely on the present unusual situation, prices are sooner or later expected to come more nearly in line with contract levels. Interference with contract shipments has affected steel-making as well as foundry iron.

### PITTSBURGH—Feb. 27

Car supplies at steel mills have improved slightly, resulting in slightly heavier shipments of finished steel but production, although curtailed, is still somewhat less than shipments. Coke shipments have increased a trifle, but much coke en route has reached destination and the number of blast furnaces banked has been decreased by one-third or one-half. Several mills idle on account of lack of coal have resumed. Cases of improvement in transportation conditions are so sporadic that no basis is afforded for expecting general or speedy relief.

Steel is being produced and shipped at about 10% under capacity while pig-iron production is still at least 10% under normal. The steel market is very quiet but there is a considerable volume of routine contracting, mills placing regular customers under contract for additional periods, and the Steel Corporation will hardly show more than a small loss in unfilled tonnage during February, the curtailment in shipments helping to prevent a large loss being shown.

Ship plates continue active and two new shipyards are in the market, one on Staten Island and one at Superior, Wis. Steel bars and shapes are quiet. There is pressure for sheets and tin plates for early delivery, with mills already far behind in deliveries. Tubular goods and wire products are fairly active.

**Pig Iron**—Up to $38, valley, has been paid for prompt foundry iron. Prices are irregular as only prompt deliveries are desired and that is a question of the situation of buyer and seller. The pig-iron districts are practically isolated from each other, and some districts are higher than others by more than the freight between them. Bessemer and basic are in only moderate demand. Sharpsville furnace was blown out yesterday for relining. Scottdale and one of the Josephine stacks, scheduled to blow in a fortnight ago after repairs, are still out, having no coke. We quote prompt deliveries at $35@38 for foundry and malleable, $36 for bessemer and $30@31 for basic, and forward at $35 for bessemer and $30 for basic, forward being unquotable except by inference from basic, which usually sells at the same level. Quotations named are f.o.b. valley furnaces, 95c. higher delivered Pittsburgh. A southern producer is reported to have advanced from $25 to $30, Birmingham.

**Steel**—Prompt deliveries of soft steel are nominally $65, at which sales were recently made, but higher prices would be paid by some consumers. There is a more complete lack of interest in forward deliveries, and in some quarters a decline is expected.

## Coke

**Connellsville**—Last week opened with relatively good supplies, ending very poorly, while this week opened poorly. Yesterday $12 to $13 was paid for spot furnace coke, and up to $15 for spot foundry, but today the market is quotable about $11.50@12.50 for furnace and $13@14 for foundry.

## STOCK QUOTATIONS

| N. Y. EXCH.† | Feb. 27 |
|---|---|
| Alaska Gold M. | 7⅛ |
| Alaska Juneau | 7 |
| Am. Sm. & Ref., com. | 98⅜ |
| Am. Sm. & Ref., pf. | 111½ |
| Am. Sm. Sec., pf. A | 100 |
| Am. Sm. Sec., pf. B. | 95½ |
| Am. Zinc | 37 |
| Am. Zinc, pf. | 66 |
| Anaconda | 79⅜ |
| Batopilas Min. | 1⅛ |
| Bethlehem Steel | 129 |
| Bethlehem Steel, pf. | 120 |
| Butte & Superior | 47 |
| Cerro de Pasco | 39 |
| Chile Cop. | 23½ |
| Chino | 55½ |
| Colo. Fuel & Iron | 47 |
| Crucible Steel | 65⅛ |
| Dome Mines | 19⅜ |
| Federal M. & S. | 14½ |
| Federal M. & S., pf. | 41 |
| Great Nor., ore ctf. | 32½ |
| Greene Cananea | 41½ |
| Homestake | 126 |
| Inspiration Con. | 57⅜ |
| International Nickel | 41 |
| Kennecott | 44½ |
| Lackawanna Steel | 79 |
| Miami Copper | 39 |
| Nat'l Lead, com. | 56½ |
| National Lead, pf. | 108½ |
| Nev. Consol. | 24⅛ |
| Ontario Min. | 5⅛ |
| Quicksilver | 2½ |
| Quicksilver, pf. | 2½ |
| Ray Con. | 27 |
| Republic I. & S., com. | 77 |
| Republic I. & S. pf. | 101½ |
| Sloss-Sheffield | 60 |
| Tennessee C. & C. | 15 |
| U. S. Steel, com. | 108⅜ |
| U. S. Steel, pf. | 117⅜ |
| Utah Copper | 110½ |
| Va. Iron C. & C. | 55 |

| N. Y. CURB† | Feb. 27 |
|---|---|
| Buffalo Mines | 1⅜ |
| Butte & N. Y. | 2⅛ |
| Butte C. & Z. | 11½ |
| Caledonia | .62 |
| Can. Cop. Corpn. | 1⅜ |
| Carlisle | 6 |
| Cashboy | .06 |
| Con. Ariz. Sm. | 2½ |
| Con. Coppermines | 3 |
| Con. Nev.-Utah | .12½ |
| First Nat. Cop. | 3 |
| Florence | ‡.70 |
| Goldfield Con. | .64 |
| Goldfield Merger | .07½ |
| Granite | 1 |
| Hecla Min. | 7 1/16 |
| Howe Sound | 6⅜ |
| Jerome Verde | 1 1/16 |
| Joplin Ore & Spel. | .27 |
| Kerr Lake | 4 11/16 |
| Magma | 49 |
| Majestic | .75 |
| McKinley-Dar-Sa. | .53 |
| Mother Lode | .39 |
| Nevada Hills | .21 |
| N. Y. & Hond. | 15 |
| Nipissing Mines | 8½ |
| Ohio Cop. | 1 1/16 |
| Ray Hercules | 4⅛ |
| Rochester Mines | .59 |
| St. Joseph Lead | 18½ |
| Standard S. L. | .75 |
| Stewart | ⅜ |
| Success | .46 |
| Tonopah | 6½ |
| Tonopah Ex. | 3 3/16 |
| Tribullion | ⅜ |
| Troy Arizona | .62 |
| United Verde Ext. | 39 |
| United Zinc | 4⅜ |
| White Knob, pf. | 1½ |
| White Oaks | 2 |
| Yukon Gold | 2 |

| SAN FRAN.* | Feb. 27 |
|---|---|
| Alta | .03 |
| Andes | .21 |
| Best & Belcher | .03 |
| Bullion | .02 |
| Caledonia | .15 |
| Challenge Con. | .04 |
| Confidence | .08 |
| Con. Virginia | .07 |
| Gould & Curry | .02 |
| Hale & Norcross | .03 |
| Jacket-Cr. Pt. | .05 |
| Mexican | .12 |
| Occidental | .65 |
| Ophir | .04 |
| Overman | .03 |
| Savage | .04 |
| Seg Belcher | .02 |
| Sierra Nevada | .09 |
| Union Con. | .41 |
| Utah Con. | .01 |
| Belmont | 4.30 |
| Jim Butler | .78 |
| MacNamara | .07 |
| Midway | .18 |
| Mont.-Tonopah | .21 |
| North Star | .14 |
| Rescue Eula | .25 |
| West End Con. | .65 |
| Atlanta | .13 |
| Booth | .10 |
| Comb. Frac. | .04 |
| D'field B.B. | .02 |
| D'field Daisy | .03 |
| Florence | .20 |
| Jumbo Extension | .27 |
| Kewanas | .21 |
| Round Mountain | .42 |
| Silver Pick | .11 |
| Argo | .05 |
| Ariz. Central | .10 |
| Big Jim | 1.31½ |
| Lazy Boy | .06 |
| Nellie | .19 |
| Tom Reed | 2.00 |
| United Eastern | 4.50 |
| United Western | .02 |

| BOSTON EXCH.* | Feb. 27 |
|---|---|
| Adventure | 3½ |
| Ahmeek | 101½ |
| Algomah | .90 |
| Allouez | 66½ |
| Ariz. Com., ctfs. | 12⅜ |
| Bonanza | .30 |
| Butte-Balaklava | 1⅛ |
| Calumet & Ariz. | 83 |
| Calumet & Hecla | 567 |
| Centennial | 22 |
| Copper Range | 62½ |
| Daly West | 2⅛ |
| Davis-Daly | 5½ |
| East Butte | 14 |
| Franklin | 7½ |
| Granby | 85 |
| Hancock | 16½ |
| Hedley | 16 |
| Helvetia | .40 |
| Indiana | 2 |
| Island Cr'k, com. | 62½ |
| Isle Royale | 32½ |
| Keweenaw | 3⅛ |
| Lake | 13 |
| La Salle | 3⅛ |
| Mason Valley | 5½ |
| Mass | 13½ |
| Mayflower | 2⅞ |
| Michigan | 3⅛ |
| Mohawk | 83 |
| New Arcadian | 4½ |
| New Idria | 15 |
| North Butte | 21½ |
| North Lake | 1½ |
| Ojibway | 2 |
| Old Colony | 2½ |
| Old Dominion | 63 |
| Osceola | 89 |
| Quincy | 92 |
| St. Mary's M. L. | 84 |
| Santa Fe | 1⅜ |
| Shannon | 9 |
| Shattuck-Ariz. | 27 |
| So. Lake | 4 |
| So. Utah | .28 |
| Superior | 14 |
| Superior & Bost. | 6½ |
| Tamarack | 56½ |
| Trinity | 4½ |
| Tuolumne | 1½ |
| U. S. Smelting | 56½ |
| U. S. Smelt'g, pf. | 50⅜ |
| Utah Apex | 2½ |
| Utah Con. | 17½ |
| Utah Metal | 5⅛ |
| Victoria | 4½ |
| Winona | 4 |
| Wolverine | 52½ |
| Wyandot | 1⅛ |

| BOSTON CURB* | Feb. 27 |
|---|---|
| Alaska Mines Corp. | 1½ |
| Bingham Mines | 9 |
| Boston Ely | .35 |
| Boston & Mont. | .69 |
| Butte & Lon'n Dev. | .22 |
| Calaveras | 4⅛ |
| Calumet-Corbin | .01⅛ |
| Chief Con. | 1⅜ |
| Cortez | .30 |
| Crown Reserve | .35 |
| Crystal Cop. | .80 |
| Eagle & Blue Bell | 1½ |
| Houghton Copper | 1 |
| Iron Cap Cop., pf. | 16 |
| Mexican Metals | .28 |
| Mines of America | 2 |
| Mojave Tungsten | .63 |
| Nat. Zinc & Lead | .60 |
| Nevada-Douglas | 2 1/16 |
| New Baltic | 2 |
| New Cornelia | 18 |
| Oneco | .60 |
| Pacific Mines | .35 |
| Rex Cons | .34 |
| Rilla | .05 |

| SALT LAKE* | Feb. 27 |
|---|---|
| Big Four | .76 |
| Black Jack | .06½ |
| Cardiff | 6.00 |
| Colorado Mining | .16 |
| Crown Point | .04 |
| Daly-Judge | 8.60 |
| Emma Cop. | 1.25 |
| Empire Copper | 1.50 |
| Gold Chain | .20 |
| Grand Central | .50 |
| Iron Blossom | 1.25 |
| Lower Mammoth | .03 |
| May Day | .09 |
| Moscow | .12 |
| Prince Con. | 1.32½ |
| Seven Troughs | ‡.03½ |
| Silver-King Coal'n. | 3.17½ |
| Silver King Con. | 4.52½ |
| Sioux Con. | .12½ |
| So. Hecla | 1.30 |
| Uncle Sam | .04 |
| Wilbert | .11 |
| Yankee | .14 |

| TORONTO* | Feb. 27 |
|---|---|
| Bailey | .06 |
| Beaver Con. | .45 |
| Chambers Feriand. | .15 |
| Coniagas | 4.20 |
| La Rose | .50 |
| Peterson Lake | .12½ |
| Right of Way | .04 |
| T. & Hudson Bay | 43.00 |
| Temiskaming | .55 |
| Wettlaufer-Lor. | .09 |
| Dome Exten. | .28½ |
| Dome Lake | .27 |
| Foley O'Brien | .70 |
| Hollinger | 5.30 |
| Jupiter | .30 |
| McIntyre | 1.85 |
| Newray | 1.16 |
| Porcu. Crown | .67 |
| Schumacher | .65 |
| Vipond | .46 |
| West Dome | .28 |

## STOCK QUOTATIONS—Continued

| COLO. SPRINGS | Feb. 27 |
|---|---|
| Cresson Con. | 6.50 |
| Doctor Jack Pot. | .08½ |
| Elkton Con. | .10½ |
| El Paso | .30 |
| Findlay | .04 |
| Gold Sovereign | .05 |
| Golden Cycle | 2.31½ |
| Granite | .58 |
| Isabella | .20½ |
| Mary McKinney | .28 |
| Portland | 1.79 |
| Vindicator | .90 |

| LONDON | Feb. 8 | | |
|---|---|---|---|
| Alaska Mexican | £0 | 12s | 6d |
| Alaska Tre'dwell | 2 | 10 | 0 |
| Burma Corp. | 3 | 15 | 0 |
| Cam & Motor | 0 | 9 | 9 |
| Camp Bird | 0 | 5 | 6 |
| El Oro | 0 | 7 | 0 |
| Esperanza | 0 | 7 | 9 |
| Mexico Mines | 4 | 7 | 6 |
| Nechi, pfd. | 0 | 12 | 6 |
| Oroville | 0 | 15 | 0 |
| Santa Ger't'dis | 0 | 8 | 3 |
| Tomboy | 0 | 19 | 6 |

* Bid prices. † Closing prices. ‡ Last Quotations.

## MONTHLY AVERAGE PRICES OF METALS

| Silver | New York | | | London | | |
|---|---|---|---|---|---|---|
| | 1915 | 1916 | 1917 | 1915 | 1916 | 1917 |
| January | 48.855 | 56.775 | 75.630 | 22.731 | 26.960 | 36.682 |
| February | 48.477 | 56.755 | 77.585 | 22.753 | 26.975 | 37.742 |
| March | 50.241 | 57.935 | ..... | 23.708 | 27.597 | ..... |
| April | 50.250 | 64.415 | ..... | 23.709 | 30.662 | ..... |
| May | 49.915 | 74.269 | ..... | 23.570 | 35.477 | ..... |
| June | 49.034 | 65.024 | ..... | 23.267 | 31.060 | ..... |
| July | 47.519 | 62.940 | ..... | 22.597 | 30.000 | ..... |
| August | 47.163 | 66.083 | ..... | 22.780 | 31.498 | ..... |
| September | 48.680 | 68.515 | ..... | 23.591 | 32.584 | ..... |
| October | 49.385 | 67.855 | ..... | 23.925 | 32.361 | ..... |
| November | 51.714 | 71.604 | ..... | 25.094 | 34.192 | ..... |
| December | 54.971 | 75.765 | ..... | 26.373 | 36.410 | ..... |
| Year | 49.684 | 65.661 | ..... | 23.675 | 31.315 | ..... |

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

| Copper | New York | | London | | | |
|---|---|---|---|---|---|---|
| | Electrolytic | | Standard | | Electrolytic | |
| | 1916 | 1917 | 1916 | 1917 | 1916 | 1917 |
| Jan. | 24.008 | 28.673 | 88.083 | 131.921 | 116.167 | 142.895 |
| Feb. | 26.440 | 31.750 | 102.667 | 137.895 | 133.167 | 148.100 |
| Mar. | 26.310 | ..... | 107.714 | ..... | 136.000 | ..... |
| April | 27.895 | ..... | 124.319 | ..... | 137.389 | ..... |
| May | 28.625 | ..... | 135.457 | ..... | 152.522 | ..... |
| June | 26.601 | ..... | 112.432 | ..... | 137.455 | ..... |
| July | 23.865 | ..... | 95.119 | ..... | 125.500 | ..... |
| Aug. | 26.120 | ..... | 110.283 | ..... | 126.304 | ..... |
| Sept. | 26.855 | ..... | 113.905 | ..... | 134.071 | ..... |
| Oct. | 27.193 | ..... | 122.750 | ..... | 142.523 | ..... |
| Nov. | 30.625 | ..... | 134.659 | ..... | 155.432 | ..... |
| Dec. | 31.890 | ..... | 145.316 | ..... | 162.842 | ..... |
| Year | 27.202 | ..... | 116.059 | ..... | 138.281 | ..... |

| Tin | New York | | London | |
|---|---|---|---|---|
| | 1916 | 1917 | 1916 | 1917 |
| January | 41.825 | 44.175 | 175.548 | 185.813 |
| February | 42.717 | 51.420 | 181.107 | 198.974 |
| March | 50.741 | ..... | 193.609 | ..... |
| March | 51.230 | ..... | 199.736 | ..... |
| May | 49.125 | ..... | 196.511 | ..... |
| June | 42.231 | ..... | 179.466 | ..... |
| July | 38.510 | ..... | 168.357 | ..... |
| August | 38.565 | ..... | 169.870 | ..... |
| September | 38.830 | ..... | 171.345 | ..... |
| October | 41.241 | ..... | 179.307 | ..... |
| November | 44.109 | ..... | 186.932 | ..... |
| December | 42.635 | ..... | 183.368 | ..... |
| Av. year | 43.480 | ..... | 182.096 | ..... |

| Lead | New York | | St. Louis | | London | |
|---|---|---|---|---|---|---|
| | 1916 | 1917 | 1916 | 1917 | 1916 | 1917 |
| January | 5.921 | 7.626 | 5.826 | 7.530 | 31.167 | 30.500 |
| February | 6.246 | 8.636 | 6.164 | 8.595 | 31.988 | 30.500 |
| March | 7.136 | ..... | 7.375 | ..... | 34.440 | ..... |
| April | 7.630 | ..... | 7.655 | ..... | 34.368 | ..... |
| May | 7.463 | ..... | 7.332 | ..... | 32.967 | ..... |
| June | 6.936 | ..... | 6.749 | ..... | 31 011 | ..... |
| July | 6.352 | ..... | 6.185 | ..... | 28.137 | ..... |
| August | 6.244 | ..... | 6 088 | ..... | 29 734 | ..... |
| September | 6.810 | ..... | 6.699 | ..... | 30.786 | ..... |
| October | 7.000 | ..... | 6.898 | ..... | 30.716 | ..... |
| November | 7.042 | ..... | 6.945 | ..... | 30.500 | ..... |
| December | 7.513 | ..... | 7.405 | ..... | 30.500 | ..... |
| Year | 6.858 | ..... | 6.777 | ..... | 31.359 | ..... |

| Spelter | New York | | St. Louis | | London | |
|---|---|---|---|---|---|---|
| | 1916 | 1917 | 1916 | 1917 | 1916 | 1917 |
| Jan. | 16.915 | 9.619 | 16.745 | 9.449 | 89.810 | 48.329 |
| Feb. | 18.420 | 10.045 | 18.260 | 9.876 | 97.762 | 47.000 |
| Mar. | 16.846 | ..... | 16.676 | ..... | 95.048 | ..... |
| April | 16.695 | ..... | 16.525 | ..... | 99.056 | ..... |
| May | 14.276 | ..... | 14.106 | ..... | 94.217 | ..... |
| June | 11.752 | ..... | 11.582 | ..... | 68.591 | ..... |
| July | 8.925 | ..... | 8.755 | ..... | 50.750 | ..... |
| Aug. | 8.730 | ..... | 8.560 | ..... | 51.587 | ..... |
| Sept. | 8.990 | ..... | 8.820 | ..... | 52.095 | ..... |
| Oct. | 9.829 | ..... | 9 659 | ..... | 54.159 | ..... |
| Nov. | 11.592 | ..... | 11.422 | ..... | 56.023 | ..... |
| Dec. | 10.665 | ..... | 10.495 | ..... | 55.842 | ..... |
| Year | 12.804 | ..... | 12.634 | ..... | 72.071 | ..... |

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. ‡ Not reported.

| Pig Iron, Pitts. | Bessemer‡ | | Basic‡ | | No. 2 Foundry | |
|---|---|---|---|---|---|---|
| | 1916 | 1917 | 1916 | 1917 | 1916 | 1917 |
| January | $21 60 | $35.95 | $18 78 | $30.95 | $19.70 | $30.95 |
| February | 21.16 | ..... | 18.93 | ..... | 19.51 | ..... |
| March | 21.81 | ..... | 19.20 | ..... | 19.45 | ..... |
| April | 21.65 | ..... | 18.95 | ..... | 19.45 | ..... |
| May | 21.78 | ..... | 19.11 | ..... | 19.58 | ..... |
| June | 21.95 | ..... | 18.95 | ..... | 19.34 | ..... |
| July | 21.95 | ..... | 18.95 | ..... | 19.20 | ..... |
| August | 21.95 | ..... | 18.95 | ..... | 19.23 | ..... |
| September | 22.88 | ..... | 19.58 | ..... | 19.53 | ..... |
| October | 24.61 | ..... | 21.26 | ..... | 21.51 | ..... |
| November | 30.07 | ..... | 28.18 | ..... | 26.55 | ..... |
| December | 35.16 | ..... | 30.95 | ..... | 30.79 | ..... |
| Year | $23.88 | ..... | $20.98 | ..... | $21.15 | ..... |

‡ As reported by W. P. Snyder & Co.

# The Mining Index

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for the foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over an order in coupons if so requested.

### COPPER

4929—ARIZONA—Rejuvenation of the Old Camp of Chloride, Arizona. U. S. G. Todd. (Salt Lake Min. Rev., Dec. 30, 1916; 2⅝ pp., illus.) 20c.

4930—BOLIVIA—El Origen de los Yacimientos Cupriferos de Corocoro y de Otros Semejantes en Bolivia. Gustavo Steinmann. (Revista Minera, Oruro, Bolivia, Sept., 1916; 32½ pp., illus.)

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